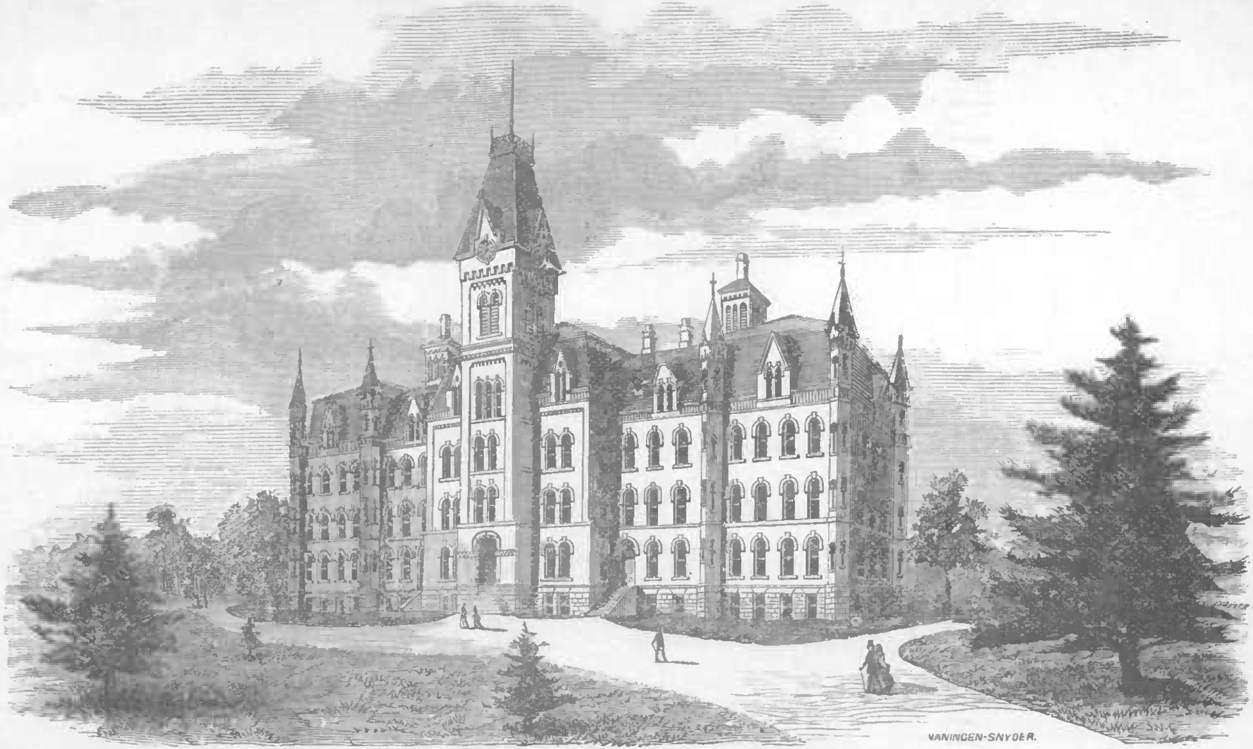

OHIO AGRICULTURAL AND MECHANICAL COLLEGE, COLUMBUS, OHIO.

The building is divided into five sections; the central, 67 feet front by 109 feet deep; two connecting wings, each 40 feet front by 44 feet deep; and two terminal wings.

REPORT

OF THE

COMMISSIONER OF AGRICULTURE

FOR

THE YEAR 1871.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1872.

FORTY-SECOND CONGRESS—SECOND SESSION.

IN THE HOUSE OF REPRESENTATIVES,
May 24, 1872.

The following resolution, originating in the House on the 7th instant, has this day been concurred in by the Senate:

Resolved by the House of Representatives, (the Senate concurring,) That there be printed of the Annual Report of the Commissioner of Agriculture for 1871, two hundred and fifty-five thousand extra copies, one hundred and eighty thousand of which shall be for the use of the House, fifty thousand for the use of the Senate, and twenty-five thousand for distribution by the Commissioner of Agriculture.

Attest:

EWD. McPHERSON,
Clerk.

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REPORT

OF

THE COMMISSIONER OF AGRICULTURE.

DEPARTMENT OF AGRICULTURE,
Washington, D. C., November 15, 1871.

SIR: In accordance with the requirement of the act of Congress establishing the Department of Agriculture, I have the honor to submit my first annual report.

There is scarcely a nation upon earth whose people have not recently been startled into action to promote that great interest in which more than one-half the world is actually employed and upon the success of which the other portion is dependent. The segregated character of the rural population has been such as to forbid that concentration of ideas and consultation of views which are so common to all other professions and occupations. But recently, through the instrumentality of agricultural journals and the establishment of agricultural societies and colleges, farmers have been brought to discover that there is work for them to do outside of the precincts of the farm. They seem to have been startled into a determined purpose to take their place in the race of the world's progress, and to assert for themselves a position which will enable them to keep pace with all others whose goal is success in life.

It is the purpose of this Department to encourage and aid this new spirit of improvement, having due regard to "the general designs and duties" imposed by the act of Congress establishing it, which are, "to acquire and diffuse among the people of the United States useful information on subjects connected with agriculture in the most general and comprehensive sense of that word, and to procure, propagate, and distribute among the people new and valuable seeds and plants." No language could be more comprehensive to express the power of this Department, or to enlarge the field of usefulness over which its influence may be extended; but it is this almost undefined power and the vast expanse of this field that render the task difficult to determine what shall be done to promote the great agricultural interests of the country. If a power thus concentrated, with agencies in every county of every State, and facilities for correspondence with all the countries of the world, should not be able to collect knowledge essential to the interests of the people, and seeds and products for distribution which are new and valuable, the failure would be traceable to its own inefficiency, and not to its want of means to do good.

There is, perhaps, no occupation in life which so greatly needs the fostering care of the Government as that of farming. There is no principle of political economy, no question of public policy, no consideration of statistical facts, no new development of scientific knowledge, which does not come home to be measured in its influence upon the results of the farm. This Department, as I view it, has been established to care for these interests, and it invokes our anxious study to know how this shall be best done. My experience in observing the workings of the Department has not been long enough to enable me either to pronounce upon its excellence or to hastily dictate points of improvement, but time and zeal in the effort to give efficiency to its work may enable me to extend its usefulness.

It will be remembered that, by the act of the 2d of July, 1862, Congress donated to the States public lands to "provide colleges for the benefit of agriculture and the mechanic arts." This was a new and important era, and may be said to mark the beginning of scientific knowledge as it pertains to agriculture. It must be conceded that the literary institutions of the country educate boys to a state of total unfitness for the occupations of the farm. The father finds his boy, after his return from an absence of a single year, to have had his thoughts and views centered upon an outside world, and when he has graduated and returns after an absence of four years, he gazes around to conclude that the farm is no place for him; his father and mother and brothers and sisters are no companions for him; his thoughts and theirs have been pursuing different paths; all congeniality of feeling is lost and gone, and he is driven to the nearest county town to prepare himself to make a poor figure in professional life, and perchance to be led into the haunts of intemperance and vice, realizing for his anxious parents, not only the loss of the hardly-earned expenses of his education, but the loss of the son himself. But the boy whose acquaintance with natural science and modern languages is accompanied by the study and observation of how plants live and feed and die; how implements are formed, and how their mechanical structure and shape are adapted to the work they do; how the earth itself lives and breathes and dies; and who is accustomed to study and ponder these things as he learns the practical operations of the work itself, returns to his father's home upon the farm, proud of his father's occupation, and happy in the associations of his family and friends; and far more so because of the light which he may shed around him, the position which his education will give him among his fellows and the success which will be sure to characterize his after life. I speak in no disparagement of, and with no desire to make unfavorable impressions in regard to, universities, colleges, and schools, in which youth are trained for professional life, but I claim that the agriculturists of the country shall have a place where their youth may be imbued with the light of science, and thus fitted for agricultural life.

The wisdom of Congress having provided for the endowment of an

agricultural college in every State, these institutions are about to perform a most important part in the destinies of the country. They are yet in their infancy; professors and teachers are themselves yet untaught; agricultural education in this land is a new idea which has but now struck the public mind and is yet to be matured, and a curriculum established which shall have for its object the education of youth in the science and art of cultivating the soil. If these institutions will but confer together, and adopt such principles of action as shall be common to them all, and not inconsistent with the habits of the people in their several localities; establish subjects of study and rules of discipline and graduation; and, especially, if they will recognize and act upon the fact that this Department and they are engaged in the prosecution of a common cause, and that the Department may be made the nucleus around which may be collected the knowledge of inventions, statistics and rare facts, new and improved seeds and plants, to be disseminated, distributed, and experimented upon by the instrumentality of agricultural colleges, the farmer will be benefited to a degree which will be felt throughout every vein and artery of our common country. But to attain this object, agricultural colleges should be distinctive in their character, and should be made to require compulsory labor of at least twelve hours a week from each of their pupils, thus training their tastes and habits, and inuring them to the daily occupation of a farmer's life, and thus, also, answering the objections often made to agricultural colleges, that their graduates at last choose the business of professional life.

An intimate relation between this Department and the agricultural colleges of the country would produce the most profitable information. If the result of their experiments in crops, the value of fertilizers, the nutritive value of various kinds of food, and the mode of planting, cultivating, harvesting, and storing were all concentrated at this Department, and analyzed and published, what a fund of knowledge would be thus collected and disseminated among the people, and how much more likely would that class who are to be benefited by this knowledge be reached through the instrumentality of these institutions than they now are by the course pursued. I do not profess to have matured the subject, and now only introduce it that it may command the consideration of the minds of men who know and feel how important it is that the agricultural improvements of the country should keep pace with the world's progress in all else.

It must be conceded that the course of agriculture in the Southern States has not been conducted with that care, skill, and regard for ultimate results which have characterized the operations of farmers in other States. While their lands are continuously devoted to cotton and tobacco until they have arrived at a state of exhaustion, those of the North are continually improving by rotation of crops, which is absolutely essential to the life of the soil itself, and without which farming

and planting had better be abandoned. These impressions have induced me to turn my attention to these States to seek some mode by which the influence of this Department may be directed to benefit them; to find out whether their implements, and especially their seeds, may not be greatly improved; and how, in the distribution of seeds and plants, we may best reach those to whom they may be profitably sent.

The agriculture of the Southern States suffers greatly in its interests for want of grasses, in the use of which its productions would be greatly increased, by rendering a rotation of crops necessary. It will be an effort of this Department to introduce this idea, as well as the seeds by which it may be carried out. Clover, with its deep roots, and rye-grass, a strong grower, will well endure the hot sun of the South; and, if preceded by an application of lime, they are sure to grow luxuriantly.

The report of the superintendent of the seed division, and our correspondence with practical farmers, strongly impress my mind with the immense benefit which the distribution of seeds confers upon the country. I do not hesitate to assert that the increased production of wheat, oats, and grasses, by reason of the distribution of new and improved seeds, pays more than ten times the whole amount expended by the Government in this Department, and such is the appreciation of this by the farmers of the country that the demands upon us are daily increasing to a degree beyond our ability to supply. It is very desirable that the efforts of the Department should be especially directed to obtain the most approved cereals, grasses, and plants which the world affords, that they may be put into the hands of our enterprising people. But in the distribution of seeds I am satisfied that the mode heretofore pursued is erroneous. The quantity sent is entirely too small for even an experiment. A pint or a quart of wheat, oats, or other cereal, cannot be successfully grown, and such experiments almost uniformly fail because the quantity is too small. I need not here discuss the reasons for this, but the result is manifest to those who have tried the experiment. It would be far better to put a half or whole bushel of seed into the hands of one conscientious and careful person than to divide the same quantity among ten or twenty.

I regard, also, the mode of distribution of our annual report as very objectionable. Indeed, in my judgment, it should not be published at all, but should be entirely superseded by the monthly reports which it is now the practice of the Department to issue. These may contain all the information that should emanate from the Department during the year, and the last one, containing the commissioner's report, should be a condensed summary of the operations of the year. But if it be the pleasure of Congress to continue the annual publication, I suggest that a much smaller number than has been customary be delivered for gratuitous distribution, and that the greater part of the edition be deposited with the Public Printer, to be sent to all persons who would order the books and pay their first cost and postage for delivery. This,

I am advised, would be 66½ cents a volume, making an allowance of 10 per cent. for the expense of wrapping and posting. The daily applications for this book, which the Department has not, convince me that thousands would gladly pay so small a sum to obtain that which they so much desire to have.

The annual report for the year 1870 has been greatly delayed by an effort to obtain statistical facts which were deemed important; but there is no reason why this publication, if it is expedient to make it at all, should not be issued as early as the month of March in each year. It will not be delayed again.

I have been so short a time in the Department that I have not yet discovered all its results nor all its powers of usefulness, and especially have I not yet been able to devise the ways and means by which these powers may be most profitably exercised for the public good. But if a natural fondness for agriculture, and a zealous interest in its success, shall enable me to give tone and character to the Department, it will not suffer in my hands. I am the more satisfied of this because I am surrounded by men of the very highest character and attainments in the several divisions to which they belong. Hence, I am never at a loss for an intelligent and satisfactory answer to any inquiry made of the Department.

DIVISION OF HORTICULTURE.

The laying out of the grounds of the Department according to the original design is progressing as rapidly as means will allow. The classified arrangement of trees in the arboretum is also very far advanced toward completion. This part of the improvement promises to be of much interest, and will, no doubt, soon be followed by the formation of similarly arranged collections in public parks, and in the grounds of public institutions, colleges, and schools.

In the exotic department a very large collection of economic and useful plants is under cultivation, and valuable accessions are constantly being received, either by purchase or through exchanges with foreign governments. It is proposed to encourage the formation of similar interesting collections in connection with the agricultural colleges, several of which have already availed themselves of the assistance of the Department in establishing conservatories, where the principal representative, medical, oil-producing, and other plants that furnish valuable commercial products may be seen and studied.

One of the most promising of fiber plants now being extensively propagated is the so-called New Zealand flax, (*Phormium tenax.*) This plant possesses a strong fiber, well fitted for cordage and similar purposes. Whether this fiber can be successfully separated from the leaves will be a question for chemical determination. The plant is adapted to cultivation in all the Southern States, and flourishes in undrained, swampy and low lands which are unfitted for cotton or corn crops.

STATISTICAL DIVISION.

The operations of the statistical division, including the editing and issue of all the publications of the Department, have been conducted with industry and intelligence, and are becoming more systematic and comprehensive, embracing wider areas and a broader range of information. No effort will be spared to insure accuracy and completeness in this important branch of Department services.

One of the most important items of special work now engaging the attention of this division is the collection of facts illustrating the agricultural status of the Rocky Mountains and the Pacific Slope, showing the progress of settlement and colonization, the yield and quality of production, the peculiarities and profit of agricultural labor, and the wants and capabilities of that great continental area. I propose to accomplish what may be done this year, with the means and facilities at command; and suggest that, if it be the pleasure of Congress to make a small special appropriation for the continuance of the work in the coming year, the country would be greatly benefited.

CHEMICAL DIVISION.

Two extensive investigations in the chemical division were commenced early in the year. One of these, the analysis of several hundred specimens of cereals, carefully selected from the whole production of the country, and accompanied by full information in regard to the methods and conditions of cultivation, it is hoped will prove of general value and interest. The examination of the leaf, stem, and fruit of the grapevine, at every week of its growth, has also been undertaken, and is nearly completed. By this work it is expected that new analogies in animal and vegetable physiology will be established, and information gained which bears directly upon the diseases of the vine. Several hundred determinations of the most accurate sort are required, and the time of one assistant is entirely occupied by them.

To enable the chemist to devote himself to those important subjects in agricultural science which await and demand chemical research, I am strongly of the opinion that the public privilege should be restricted to the employment of the laboratory for such purposes only as relate to agriculture. It is evident that if the laboratory were to continue to be held subject to all the miscellaneous demands which have heretofore been made upon it, not only would original investigation be prevented, but an increase of force would be required. The law at present provides only for the employment of a chemist and an assistant.

The apparatus and fixtures of the laboratory have received a few additions, and, with the exception of occasional special needs in original research, may now be considered as complete.

ENTOMOLOGICAL DIVISION AND MUSEUM.

During the last year the correspondence of the entomological division has largely increased, letters having been received and answered concerning injurious insects, birds, quadrupeds, and other branches of natural history, and fruits, fibers, and such subjects as relate to the museum. Investigations have been made into the habits of insects in respect to their food, transformations, &c., and into the best remedies now used to destroy those that are particularly injurious to the farmer. Full experiments have been made in rearing the silk-worm (*Bombyx mori*) on the leaves of the Osage orange, (*Maclura auriantiaca.*) The worms fed greedily, were perfectly healthy, and spun large-sized cocoons of very fair silk.

Cases are much needed for the special reception of the valuable and growing collection of insects now in boxes, and accessible only to entomologists. When such cases are provided, the entire collection will be arranged and labeled, so that the beneficial and the injurious species may be pointed out at a glance. A collection has been commenced with the design of showing the nature of the injuries by insects upon various substances, together with the economic products made by them, as cochineal, gums, &c., and their nests and cocoons. Such a collection is of special value in a cabinet of entomology, as the farmer or fruit-grower can at once identify any insect by comparison of the injury caused by it with the specimen in the cabinet.

During the year large collections of fruits and vegetables have been received from many localities. All these have been modeled and properly labeled and placed in the museum, together with a fine collection of tropical fruits from South America, done in *papier-maché*. Many other valuable additions have been made to the museum during the year, prominent among which may be mentioned the fine collection of fibers made by Dr. H. Perrine, in Florida, several years ago, and presented by the Smithsonian Institution, and a similar collection made by the botanist of the Department while in Santo Domingo; collections of insects from the Smithsonian Institution and from geological surveys; a collection of foreign game-birds by the curator; Chinese and Japanese papers, cocoons, silk, &c.; and contributions in other Departments.

THE LIBRARY.

The number of volumes now in the library is 6,012, of which there have been added during the year 1,064, inclusive of 500 volumes received from the Secretary of the Interior. About one-half of the whole number added relate to agriculture and the allied sciences of pomology, entomology, agricultural geology, microscopy, and natural history, all valuable for reference on questions continually discussed in the correspondence and reports of the Department. Those donated by the Secretary of the Interior are composed principally of public documents.

The library continues to receive the journals and reports of the lead-

ing agricultural and scientific associations of the world, many of which are in exchange for the annual and monthly reports of the Department. Some of the French journals have been suspended by the war with Germany, but doubtless their publication will soon be resumed and the exchange continued. All of these works are carefully preserved, and in themselves form a useful collection for reference in the scientific and statistical investigations of the day. Many of them are probably not accessible in any other library in the country. They furnish the results of the very latest investigations in entomology, botany, agricultural geology, and microscopy, as well as experiments in agriculture, which could be abridged and published in the monthly reports of the Department before they are reproduced by the agricultural journals of the country.

Many of the sets of State agricultural reports and periodicals being incomplete, steps have been taken to supply the volumes and numbers that were missing. This has been accomplished in nearly every instance without expense to the Department. The library now contains sets, generally complete, of the transactions of the boards of agriculture of all the leading States of the Union for the last twenty years.

There are now nearly 500 volumes of miscellaneous agricultural publications at the Government bindery for binding or rebinding.

A catalogue of the library is being prepared, in which will be classified the most important subjects, so that persons wishing to investigate any particular topic can see at a glance the titles of all the works relating to it.

EXCHANGE OF SEEDS.

Since the plan of international exchanges of seeds and plants was inaugurated by my predecessor, the Department has continued the system, having found the results to be highly advantageous in adding to our collection seeds of many valuable species of useful and ornamental plants that could not be readily procured through the ordinary channels of trade, except at a very heavy outlay. Since the last report referring to these exchanges, the Department has sent two collections of tree-seeds, one containing ninety-five species, and the other one hundred and sixteen, to the Royal Botanic Gardens, at Kew, England; Royal Botanic Gardens, at Edinburgh, Scotland; Royal Botanic Gardens, at Glasnevin, and Royal Dublin Society, at Dublin, Ireland; Horticultural Society of Bremen, North German Union; Botanic Gardens, at Melbourne, Australia; Royal Minister of Agriculture, at Berlin; government of Switzerland, through Mr. John Hitz, consul general; Imperial and Royal Ministers of Agricultural Affairs, Austria and Hungary; University of Christiana, Norway; Royal Gardens, Portugal; Imperial Botanic Gardens, at St. Petersburgh, Russia; and the Kingdom of the Netherlands. From many of these correspondents the Department has received some valuable contributions, of which special mention may be made of those from the Kew Gardens, the Royal Gar-

dens at Melbourne, and the Imperial and Royal Ministers of Agricultural Affairs of Austria and Hungary. Exchanges have also been effected through the courtesy of our ministers and consuls in South America, Europe, Asia, and the Hawaiian Islands, and through these sources some of the most rare and valuable seeds and plants have been received.

During the present year correspondence has been opened with the ministers of agriculture of the South American governments for the purpose of effecting exchanges of the agricultural and other useful products of those countries which are known to be prolific of numerous medicinal and other economic plants. The result of this correspondence has been the receipt of many rare plants, consisting of palms, &c., as also donations of cereals and vegetable-seeds of rare perfection, among which may be mentioned a contribution of cereals from the president of the National Society of Santiago, Peru, embracing some of the finest specimens of wheat I have ever seen, which, with other similar contributions, will be carefully experimented with, for the purpose of testing their adaptability to our soil and climate. These South American correspondents are located in Brazil, Ecuador, Venezuela, Nicaragua, Mexico, Guatemala, and United States of Colombia. Exchanges continue with the Chinese and Japanese governments, and some valuable contributions have been received, especially from the latter.

An arrangement for exchange has been made with the colonial governments of Jamaica, which will result largely to the advantage of this Department, the colonial secretary having promised a donation of over three thousand plants of the cinchonas, embracing all the valuable varieties. This acquisition will enable the Department, at an early period, to encourage experiments in those sections of the South where there is a reasonable prospect of the successful culture of this invaluable plant, which, in the past, has been exclusively confined to certain localities in South America, but the cultivation of which has recently been commenced by the British government in the East and West Indies at a large outlay.

The international courtesies that are inaugurated and fostered by a system of mutual exchanges of the products of the soil are prolific of most valuable results. Following the successful introduction of our seeds into foreign countries, especially those in which the ruder systems of agriculture prevail, come inquiries regarding the best modes of culture, the introduction of improved machinery for the husbanding and utilizing of crops, and questions of similar import, thus extending the benefits of our improved mechanism and labor-saving farm-implements. While the advantages which must naturally flow from this source redound to the immediate benefit and permanent advancement of the important mechanical interests of this country, improved systems at the same time are introduced into those countries with which we exchange, thereby hastening their development, increasing their productions, and adding to their wealth.

THE SEED DIVISION.

The following tabular statement shows the quantity and kind of seeds issued from the seed division of this Department from November 1, 1870, to October 31, 1871, inclusive.

Cereals, seeds, and textiles.	TO WHOM SENT, AND NUMBER OF PACKAGES.						
	Senators and members of Congress.	Agricultural societies.	Correspondents.	Meteorological observers.	Miscellaneous.	Foreign countries.	Total.
VEGETABLES, 113 varieties	108, 487	74, 098	96, 732	8, 680	76, 507	1, 429	365, 933
FLOWERS, 54 varieties	79, 886	2, 778	30, 260	6, 340	63, 921	74	183, 259
CEREALS:							
Wheat, 6 varieties	12, 616	4, 756	5, 644	....	3, 359	75	26, 450
Rye, 2 varieties	752	4	2, 860	....	313	....	3, 929
Oats, 4 varieties	9, 943	8, 112	2, 211	....	2, 744	50	23, 060
Barley, 4 varieties	1, 925	5, 518	16	....	402	....	7, 861
OTHER SEEDS:							
Tobacco, 5 varieties	16, 445	20	....	....	2, 070	25	18, 560
Sorghum, 3 varieties	664	76	....	....	138	....	878
Clover, 3 varieties	869	335	2	....	590	8	1, 804
Rye-grass, 2 varieties	64	....	....	....	73	48	185
Osage orange, 1 variety	....	....	....	....	28	....	28
Opium poppy, 2 varieties	6, 480	....	....	....	462	....	6, 942
Sugar-beet, 3 varieties	76	924	....	....	73	....	1, 073
Herbs, 9 varieties	666	....	....	....	108	162	936
Mangel-wurzel, 3 varieties	1, 492	1, 532	....	....	103	....	3, 127
Madder, 1 variety	....	....	....	....	79	....	79
TEXTILES:							
Hemp, 2 varieties	42	....	....	....	83	....	125
Cotton, 3 varieties	20	....	804	....	376	....	1, 200
Ramie, 1 variety	....	....	....	....	145	....	145
Jute, 2 varieties	....	....	....	....	168	....	168
PEA-NUTS, 1 variety	....	....	....	....	....	8	8
TREE-SEEDS, 116 varieties	....	....	....	....	....	1, 571	1, 571
Total	240, 427	98, 153	138, 529	15, 020	151, 742	3, 450	647, 321

AGRICULTURAL PRODUCTIONS OF THE YEAR.

In its meteorological aspects the season has been marked by local droughts, high winds, and floods. In the later months of summer continued dry weather became rather general than local throughout a large portion of the Ohio Valley, the Missouri Valley, and the Southwestern States; and in the Rocky Mountain sections drought was more severe than usual. It is to be feared that the destruction of forests by devastating fires and for supplies of timber will render drought, winds, and floods more frequent and severe. Heavy frosts, which proved very injurious to winter grain, were general throughout the West from April 21 to 23; and autumn frosts, which arrested the growth and maturity of crops, occurred generally from 21st to 30th of September. The month of September was cooler than the corresponding month for many

years, but the high temperature of the preceding months, and especially of August, had advanced corn and other crops beyond the point of material damage from frosts.

The injury resulting from these unfavorable meteorological conditions is mainly seen in the poorer soils, or in those in inferior mechanical condition—those in the highest cultivation and of the richest quality having a power of resistance and a recuperative energy which insure good crops under circumstances apparently adverse. The records of the Department, verifying the observation of all intelligent cultivators, attest the value of perfect drainage and good culture in warding off dangers from drought and excessive moisture. Such has been the experience of the present year, which promises a moderate abundance for the supply of man and his dependent creatures of the farm. The area planted with corn was largely increased, and a larger breadth of wheat was sown. While the crop of corn will not equal the great yield of 1870, nor that of wheat the unparalleled crop of 1869, there will be an ample supply of both for the wants of this country, and tens of millions of bushels to supplement the short crops of Europe. While the product of hay is somewhat less than usual, its quality is good, and coarse forage in all sections and winter pasturage in the South and distant West are never-failing resources. Cotton will be gathered in smaller quantity, and sold at a higher price. Other crops, as a whole, promise very nearly average returns, giving moderate rewards to labor and ample supplies for necessary consumption.

FINANCIAL.

At the time I assumed the duties of Commissioner, on the 1st day of August last, the appropriations for the fiscal year ending June 30, 1871, were exhausted, except the appropriation for the "purchase and distribution of new and valuable seeds," of which there remained a balance unexpended of $7,508.96, with unsettled bills for seeds purchased in Europe, under this appropriation, amounting to about $7,300. Of the appropriations for the current fiscal year, the following statement exhibits the amounts disbursed and the unexpended balances, under their respective heads, on the 1st of August last:

Title of appropriation.	Amount disbursed to July 31, 1871.	Amount unexpended August 1, 1871.
Salaries	$6,207 92	$68,962 08
Collecting statistics	884 50	14,115 50
Purchase and distribution of seeds	....	45,000 00
Experimental garden	707 96	9,292 04
Contingent expenses	344 90	12,555 10
Furniture, cases, and repairs	185 50	4,514 50
Museum	....	2,000 00
Library	140 31	1,909 69
Laboratory	480 35	2,969 65
Improvement of grounds	7,500 00	19,300 00
Total	16,451 44	180,618 56

Showing a balance unexpended at that date of $180,618.56, which, with strict economy, will be sufficient for the successful operations of the Department during the current year.

By a late act of Congress the financial operations of the Department for each fiscal year are to be kept entirely separate. I deem it proper, therefore, to defer until the expiration of the present fiscal year a report of these operations during the three months I have had control of the Department, when a complete report will be made.

My estimates for the appropriations necessary for this Department during the fiscal year of 1873 were made and transmitted to the Secretary of the Treasury on the 17th of October. They were based on the appropriations for the present year; reduced in some respects when it could be done without injury to the successful operations of the Department, and slightly increased in other items when the necessities of the case seemed to require it, and in all respects with reference to the most rigid economy consistent with an efficient administration of the legitimate objects of the Department. The aggregate amount estimated is less than the appropriations for the current year.

I have the honor to be, very respectfully, your obedient servant,

FREDERICK WATTS,
Commissioner of Agriculture.

His Excellency U. S. GRANT,
President.

REPORT OF THE STATISTICIAN.

SIR: I have the honor to submit my seventh annual report as Statistician of the Department of Agriculture. The agricultural production of 1871 has been less, both in quantity and value, than that of 1870. The heaviest decline in production is seen in corn, which fails to reach the quantity of the previous year by one hundred millions of bushels, while it exceeds that produced in 1869 by a difference still greater. The amount of wheat harvested has apparently come very near the product of 1870; the quantity of oats grown slightly surpasses that of the previous year; and barley, rye, and buckwheat, always presenting moderate figures, differ in their aggregate of the two years by very slight degrees. The difference in the quantity of cereals is therefore mainly due to the reduction in the yield of corn, which showed, relatively, a decrease of 9 per cent., yet actually leaving more than an average crop. The total quantity of cereals, as estimated, was fully sixteen hundred and a quarter millions in 1870; and in 1871, fifteen hundred and a quarter; their values, respectively, in round numbers, one thousand millions of dollars, and nine hundred millions. As compared with other grain-producing countries, ours now stands abreast with Russia, in some years slightly ahead, while the two together equal, in cereal production, all the countries in Europe west of Russia.

The area in cereals, so far as we have been able to determine it without the help of the census—a singular omission in the national enumeration to which this Department in vain called the attention of the lawmakers prior to the census of 1870—was sixty-four millions of acres last year, and sixty-nine in 1870. More than half of this total area, as also a larger proportion of the aggregate value, is attributed to the maize crop, which is, and must be, for many years, the principal cereal crop of the country.

THE CROPS OF 1871.

CORN was planted early in the central maize-producing region of the West. Germination was quick, and growth vigorous, except as affected by local droughts and the destructive prevalence of cut-worms in sod-land. Cold rains in some portions of the West retarded growth in low-lying, or heavy, lands. There are in all the States level lands of impervious clay, without drainage, amelioration, or thorough pulverization, which must prophesy failure in seasons of heavy rain and in those of serious drought, and result inevitably in yields which fail to represent the capacity of the soil for production. In the Middle and Eastern States cut-worms were even more injurious than in the West. In the Southern States a good stand was obtained, but growth was retarded at first by cold rains. The nights of June were too cool for corn in New England and through the Alleghenian elevations as far south as Virginia, and heavy rains in Maryland and Virginia obstructed cultivation. In the South heavy rains deluged the bottom-lands, and kept the fields grassy and imperfectly cultivated. Throughout the West the crop was generally in superior condition until the middle of July, when the influence of drought began to be felt, becoming more severe in August and September, injuring materially the crop upon the lighter soils of Ohio, Michigan, Indiana, and Illinois. In Kansas the average product was reduced by drought, and in the Southwest, especially in Texas, the loss from the same cause was heavy.

WHEAT.—The winter of 1870-'71 was comparatively mild. The plants were protected, in the northern latitudes, by a sufficient covering of snow. Spring opened early, without extreme alternations of freezing and thawing, and the early growth was unusually promising. As the season advanced the usual complaints of insects, rust, and drought were received from various quarters. The chinch-bug was especially destructive, the greatest severity of its attacks appearing in the States of the Missouri Valley. Drought in California reduced the yield several millions of bushels, its greatest injuries being wrought in the valley of the San Joaquin, the center of wheat-growing in that State. In September reports were far less favorable than in the early summer, continued dry weather intensifying the depreciated condition returned in August. At this date the average depreciation was estimated at 10 per cent. Minnesota, usually successful in wheat-growing, reported a decline of 25 per cent. from the expectations of May and June, mainly in consequence of insect depredations.

These drawbacks, on the whole, were neither more numerous nor severe than in former years, and the aggregate estimate is about an average.

HAY.—The lack of rain, at many points, in May and June reduced the hay crop, as compared with that of the previous year, between two and three millions of tons, or about 10 per cent., and increased its value $13,000,000, or about 4 per cent. In the Middle and Eastern States the loss in quantity and the appreciation in price were extreme, though locally various in degree. The immense quantities of corn-fodder at command in the principal maize-growing districts, and the tens of millions of tons of straw annually wasted, are resources always drawn upon, but never exhausted in seasons of scarcity of hay. The reduction in yield was very heavy in the New England States, and notably so in Maine.

POTATOES.—In July the indications were favorable for a somewhat larger crop than that of 1870, notwithstanding late frosts at many points, drought in several sections, and the eastward march of the Colorado potato-bug, which had established a skirmish-line through the central counties of Ohio, while still operating in the more western States, though feebly, under the concentrated fire in the rear by the farmers, with their ammunition of Paris green.

The resulting crop, as estimated, is one hundred and twenty millions of bushels, exceeding the previous crop by about six millions. Value, $71,000,000, against $82,000,000 for the crop of 1870.

COTTON.—In June, 1870, when a large increase of cotton-planting was reported, the declaration was made in the Monthly that "the cotton-growers seem determined to reduce the price to 15 cents," which was accomplished within six months, by an increase of the cotton crop from a little more than three millions of bales to nearly four and a half millions; and in the report of June, 1870, it was stated that the penalty of growing four millions of bales instead of three was a reduction of 7 cents per pound, equivalent to $130,000,000 on the crop. Short-sighted political economists objected to that phase of presentation of the resulting loss, as incorrect; but when four millions of bales, at $76 per bale, produce but $304,000,000, while three millions of bales, at $109 per bale, bring $327,000,000, or $23,000,000 more for the smaller crop than for the larger, there is the additional loss of the labor employed in making the extra million of bales, instead of producing food and forage supplies, now obtained at ruinous cost from the North; and all these losses, with their

incidental results, in thwarting systematic rotation and recuperative cropping, will far exceed the $130,000,000 of the above calculation.

The crop of 1871, partly from diminution of area and partly from diminished yield, has probably fallen to the plane of that of 1869, and the price has advanced in almost equal proportion. While the recommend ations of these reports, respecting the production of cotton, have been bitterly assailed by speculators and dealers, the positions taken are impregnable, viz: that these fluctuations of production and price are injurious alike to producers and manufacturers; that cotton in the Gulf States, while the prominent crop, should not be grown so exclusively as to run the price below a living profit and create a debt for provisions and supplies; that no one crop, which can scarcely average, for years to come, however large it may be, a value of $300,000,000 (a sum less than the intrinsic annual value of wasted, undepastured grasses of the country, and scarcely greater than the actual receipts from milk in its various forms) can *alone* make the South a wealthy, or even thriving community.

The reduction in area of the crop of 1871 was estimated at 15 per cent.; the diminution of the product appears to have been fully 30 per cent. The June reports indicated a condition below an average in almost every State. The spring had been unusually wet and cold, retarding growth, obstructing cultivation, and discouraging replanting. The possibilities of production, lying between a long and favorable season and one of various disaster and early frost, were ranged from three and a half millions of bales down below three millions. In July the condition of the crop was not materially changed, and the succeeding reports were of the same tenor, comparatively unpromising, though threatening no great disaster from insects or other causes. The season proved to be a week later than the average date of killing frosts, and the estimate was placed at 3,400,000 bales, or 1,040,000 bales less than the crop of 1870. Though almost universally deemed too low by cotton-brokers, who were inclined to charge upon the Department a conspiracy to advance the price, the result will probably show a still greater decline than was indicated.

THE CROP ESTIMATES OF 1871.

In view of the fact that no national census was ever known to agree closely with a State enumeration,* and that repeated efforts by the same authority do not reach precisely the same results, it has seemed little less than temerity to attempt to estimate the varying yields of crops from year to year. Infallibly close approximation, in every instance, is, indeed, impracticable. Local statisticians find it difficult to estimate accurately for a single State; with all the States and Territories included, the distances augmented and areas for examination enlarged, the problem becomes far more difficult of solution. Were the fluctuations of production less marked, it would be easier to calculate the effect of change-producing causes. The minor crops are quite too variable for any mode of estimating that does not require at least a partial census. The extent of this fluctuation, even in the principal crops, is not generally appreciated. The assessors' returns of Ohio, which are more reliable than those of most other States making similar returns, show an aggregate of 29,916,518 bushels of wheat produced in 1862, falling off,

* The census returned 15,119,057 bushels of wheat in Ohio, grown in 1859, and the assessors 12,912,096; the census, 27,882,159 bushels grown in 1869, and the assessors, 26,499,729. The census returned 67,501,114 bushels of corn in 1859, and 73,543,190 in 1869; and the assessors 60,813,094 and 67,105,350 in those years respectively.

in the years following respectively, to twenty millions, (in round numbers,) to fifteen, to thirteen, and to less than six millions in 1866; then rising to thirteen, to sixteen, to twenty-six, (in 1869;) and falling again to eighteen millions in 1870.

There are other elements of difficulty peculiar to this changing, growing country. New States spring into existence; young States are creating new counties and peopling most densely those already existing, oftentimes with such rapidity that the more observant citizen is unable to calculate with accuracy the rate of growth. The returns of one year, therefore, fail to cover the area or the population represented by those of the next. In States like Kansas or Nebraska, this difficulty is almost insuperable.

In the South, where the changes of five years had almost obliterated important industries, and the memories of reporters in 1866 failed to make accurate comparisons with the census year 1859—where the changes of the labor system and the losses of a fearful civil war gave a gloomy tinge to the most deliberate effort of the judgment—the case was worse. Still, results have been comparatively successful wherever our system has been fully in operation, and especially with regard to the principal products.

While our plan has only been in partial operation for the latter half of a decade, its success, wherever our lists of correspondents have been complete, have been sufficient to show its superiority to any undertaken by individuals or associations. It has proved in some instances, in fact, to be more reliable than a State census. In Minnesota, where the returns received (by my predecessor) were, at first, very incomplete, and the estimates widely at fault, the wheat crop of 1869 was placed at 19,000,000 bushels; the United States census made it 18,866,073 bushels; while the State returns (assumed to be authoritative in their accuracy) gave only 17,660,467. In Illinois, without aid, year after year, of State returns or local estimates whatever, except our own, the wheat estimate was 29,200,000 bushels, while the census exhibit was 30,128,405. The crop of corn varied by a small percentage of difference, and the numbers of cattle and horses were almost exactly those of the census. Yet, in minor products, in newer or distant States, and with less complete arrangements, wide discrepancies have sometimes occurred.

The estimates of farm animals, in the following tables, are intended to include those kept in cities; the census enumeration includes only animals on farms:

Table showing the product of each principal crop of the several States named, the yield per acre, the total acreage, the average price in each State, and the value of each crop, for 1871.

Product.	Amount of crop of 1871.	Average yield per acre.	Number of acres in each crop.	Value per bushel, ton, or pound.	Total valuation.
MAINE.					
Indian corn.....bushels..	1, 078, 000	27. 2	39, 632	$0 98	$1, 056, 440
Wheat.....do....	269, 000	13	20, 692	1 80	484, 200
Rye.....do....	31, 000	17. 2	1, 802	1 19	36, 890
Oats.....do....	1, 514, 000	25	60, 560	66	999, 240
Barley.....do....	439, 000	21. 5	20, 418	87	381, 930
Buckwheat.....do....	398, 000	21	18, 952	91	362, 180
Potatoes.....do....	7, 310, 000	142	51, 478	46	3, 362, 600
Tobacco.....pounds..	....	....	....	....	....
Hay.....tons..	656, 000	. 46	1, 426, 086	26 00	17, 056, 000
Total.....	....	....	1, 639, 620	....	23, 739, 480
NEW HAMPSHIRE.					
Indian corn.....bushels..	1, 273, 000	35. 7	35, 658	95	1, 209, 350
Wheat.....do....	186, 000	15. 2	12, 236	1 72	319, 920
Rye.....do....	44, 000	18. 5	2, 378	1 13	49, 720
Oats.....do....	1, 151, 000	37	31, 108	63	725, 130
Barley.....do....	97, 000	29. 4	3, 299	98	95, 060
Buckwheat.....do....	88, 700	18. 7	4, 743	71	62, 977
Potatoes.....do....	3, 874, 000	140	27, 671	49	1, 898, 260
Tobacco.....pounds..	153, 000	900	170	20	30, 600
Hay.....tons..	535, 000	. 97	551, 546	23 00	12, 305, 000
Total.....	....	....	668, 809	....	16, 696, 017
VERMONT.					
Indian corn.....bushels..	1, 747, 000	35. 6	49, 073	99	1, 729, 530
Wheat.....do....	413, 000	16. 6	24, 879	1 62	669, 060
Rye.....do....	67, 600	16	4, 225	1 11	75, 036
Oats.....do....	3, 106, 000	35. 5	87, 492	53	1, 646, 180
Barley.....do....	108, 000	22. 8	4, 736	1 22	131, 760
Buckwheat.....do....	319, 000	21	15, 190	70	223, 300
Potatoes.....do....	4, 850, 000	160	30, 312	37	1, 794, 500
Tobacco.....pounds..	70, 700	950	74	19. 5	13, 786
Hay.....tons..	861, 000	1. 02	844, 117	17 50	15, 067, 500
Total.....	....	....	1, 060, 098	....	21, 350, 652
MASSACHUSETTS.					
Indian corn.....bushels..	1, 419, 000	34. 3	41, 370	98	1, 390, 620
Wheat.....do....	36, 000	18. 2	1, 978	1 68	60, 480
Rye.....do....	243, 000	18	13, 500	1 12	272, 160
Oats.....do....	754, 000	31. 4	24, 012	70	527, 800
Barley.....do....	123, 000	24. 2	5, 082	1 07	131, 610
Buckwheat.....do....	49, 000	15	3, 266	1 07	52, 430
Potatoes.....do....	2, 428, 000	126	19, 269	68	1, 651, 040
Tobacco.....pounds..	6, 917, 000	1, 450	4, 770	20. 5	1, 417, 985
Hay.....tons..	405, 000	. 96	421, 875	29 60	11, 988, 000
Total.....	....	....	535, 122	....	17, 492, 125
RHODE ISLAND.					
Indian corn.....bushels..	308, 000	27. 3	11, 282	99	304, 920
Wheat.....do....	700	18	38	1 65	1, 155
Rye.....do....	20, 600	19. 6	1, 051	1 05	21, 630
Oats.....do....	156, 000	33. 3	4, 684	60	93, 600
Barley.....do....	30, 900	23	1, 343	1 00	30, 900
Buckwheat.....do....	1, 400	16	87	1 05	1, 470
Potatoes.....do....	527, 000	90	5, 855	73	384, 710
Tobacco.....pounds..	....	....	....	....	....
Hay.....tons..	80, 000	. 91	87, 912	33 33	2, 666, 400
Total.....	....	....	112, 252	....	3, 504, 785

Table showing the product of each principal crop, &c.—Continued.

Product.	Amount of crop of 1871.	Average yield per acre.	Number of acres in each crop.	Value per bushel, ton, or pound.	Total valuation.
CONNECTICUT.					
Indian corn.........bushels..	1,624,000	31.4	51,719	$1 07	$1,737,680
Wheat.........do....	38,700	17	2,276	1 55	59,985
Rye.........do....	297,000	14.2	20,915	1 17	347,490
Oats.........do....	958,000	31.6	30,316	65	622,700
Barley.........do....	23,000	22	1,045	1 20	27,600
Buckwheat.........do....	97,900	24	4,079	1 00	97,900
Potatoes.........do....	1,936,000	106	18,264	68	1,316,480
Tobacco.........pounds..	8,094,000	1,700	4,761	25	2,023,500
Hay.........tons..	411,000	1.11	370,270	31 20	12,823,200
Total.........	....	....	503,645	....	19,056,535
NEW YORK.					
Indian corn.........bushels..	17,483,000	33	529,787	82	14,336,060
Wheat.........do....	9,589,000	17.2	557,500	1 51	14,479,390
Rye.........do....	2,341,000	16.6	141,024	88	2,060,080
Oats.........do....	32,610,000	39.1	834,015	51	16,631,100
Barley.........do....	6,946,000	25.9	268,185	78	5,417,880
Buckwheat.........do....	3,091,000	24.1	128,257	78	2,410,980
Potatoes.........do....	26,377,000	107	246,514	48	12,660,960
Tobacco.........pounds..	2,558,000	657	3,893	12.6	322,308
Hay.........tons..	4,221,000	1.22	3,459,836	19 42	81,971,820
Total.........	....	....	6,169,011	....	150,290,578
NEW JERSEY.					
Indian corn.........bushels..	10,559,000	36	293,305	75	7,919,250
Wheat.........do....	2,100,000	18	116,666	1 54	3,234,000
Rye.........do....	517,000	15	34,466	94	485,980
Oats.........do....	3,846,000	33.3	115,495	52	1,999,920
Barley.........do....	7,200	26	276	95	6,840
Buckwheat.........do....	289,000	16	18,062	92	265,880
Potatoes.........do....	3,935,000	96	40,989	66	2,597,100
Tobacco.........pounds..	40,400	1,150	35	18	7,272
Hay.........tons..	403,000	1.30	310,000	26 70	10,760,100
Total.........	....	....	929,294	....	27,276,342
PENNSYLVANIA.					
Indian corn.........bushels..	39,254,000	35.5	1,105,746	77	30,225,580
Wheat.........do....	19,339,000	16.2	1,193,765	1 45	28,041,550
Rye.........do....	3,336,000	14.6	228,493	86	2,868,960
Oats.........do....	31,545,000	31	1,017,580	49	15,457,050
Barley.........do....	472,000	18.6	25,376	90	424,800
Buckwheat.........do....	2,050,000	21.1	97,156	93	1,906,500
Potatoes.........do....	11,749,000	112	104,901	55	6,461,950
Tobacco.........pounds..	3,392,000	1,200	2,826	15.2	515,584
Hay.........tons..	2,050,000	.93	2,204,301	20 76	42,558,000
Total.........	....	....	5,980,144	....	128,459,974
DELAWARE.					
Indian corn.........bushels..	3,575,000	22	162,500	60	2,145,000
Wheat.........do....	688,000	11.5	59,826	1 52	1,045,760
Rye.........do....	10,100	5	2,020	75	7,575
Oats.........do....	398,000	20	19,900	41	163,180
Barley.........do....	1,700	17	100	80	1,360
Buckwheat.........do....	1,100	12.5	88	77	847
Potatoes.........do....	238,000	120	1,983	50	119,000
Tobacco.........pounds..	....	....	....	....	....
Hay.........tons..	33,000	1.25	26,400	17 50	577,500
Total.........	....	....	272,817	....	4,060,222

Table showing the product of each principal crop, &c.—Continued.

Product.	Amount of crop of 1871.	Average yield per acre.	Number of acres in each crop.	Value per bushel, ton, or pound.	Total valuation.
MARYLAND.					
Indian corn........................bushels..	11, 227, 000	23. 6	475, 720	$0 64	$7, 185, 280
Wheat ....do....	5, 654, 000	12	471, 166	1 52	8, 594. 080
Rye......................................do....	287, 000	11. 5	24, 956	85	243, 950
Oats.....................................do....	2, 563, 000	17. 7	144, 802	48	1, 230, 240
Barley ....do....	10, 900	18	605	90	9, 810
Buckwheat ....do....	50, 000	14. 2	3, 521	97	48, 500
Potatoes ....do...	1, 210, 000	71	17, 042	71	859, 100
Tobacco............................pounds..	13, 069. 000	650	20, 106	08. 2	1, 071, 658
Hay ....tons..	174, 000	1	174, 000	25 71	4. 473, 540
Total	....	....	1, 331, 918	....	23, 716, 158
VIRGINIA.					
Indian corn........................bushels..	19, 553, 000	22. 6	865, 176	67	13, 100, 510
Wheat ....do....	6, 369, 000	8	796, 125	1 39	8, 852, 910
Rye ....do....	467, 000	13. 6	34, 338	71	331, 570
Oats ....do....	5, 381, 000	16. 4	328, 109	49	2, 636, 690
Barley ....do....	6, 600	17. 5	377	80	5, 280
Buckwheat ....do....	33, 000	14. 4	2, 291	82	27, 060
Potatoes ....do....	1, 174, 000	71	16, 535	71	833, 540
Tobacco............................pounds..	39, 384, 000	708	55, 627	10. 8	4, 253, 472
Hay.......................................tons..	183, 000	1. 21	151, 239	17 82	3, 261, 060
Total..	....	....	2, 249, 817	....	33, 302, 092
NORTH CAROLINA.					
Indian corn........................bushels..	20, 700, 000	14	1, 478, 571	71	14, 697, 000
Wheat ....do....	2, 530, 000	6	421, 666	1 42	3, 592, 600
Rye ....do....	320, 000	6. 6	48, 484	86	275, 200
Oats ....do....	2, 200, 000	10. 6	207, 547	63	1, 386, 000
Barley ....do....	1, 900	16	118	65	1, 235
Buckwheat ....do....	14, 000	11. 6	1, 206	61	8, 540
Potatoes ....do....	816, 000	105	7, 771	71	579, 360
Tobacco............................pounds..	9, 600, 000	599	16, 026	10. 3	988, 800
Hay ....tons..	84, 000	1. 13	74, 336	12 30	1, 033, 200
Total..	....	....	2, 255, 725	....	22, 561, 935
SOUTH CAROLINA.					
Indian corn........................bushels..	9, 840, 000	10	984, 000	92	9, 052, 800
Wheat ....do....	586, 000	5	117, 200	2 03	1, 189, 580
Rye ....do....	46, 000	7. 1	6, 478	1 55	71, 300
Oats ....do....	537, 000	8. 9	60, 337	87	467, 190
Barley ....do....	4, 900	15	326	1 00	4, 900
Buckwheat ....do....	....	....	....	....	....
Potatoes ....do....	84, 000	95	884	1 38	115, 920
Tobacco............................pounds..	35, 000	500	70	10. 5	3, 675
Hay ....tons..	18, 500	. 60	30, 833	21 60	399, 600
Total..	....	....	1, 200, 128	....	11, 304, 965
GEORGIA.					
Indian corn........................bushels..	20, 150, 000	10. 3	1, 956, 310	93	18, 739, 500
Wheat .... do....	1, 718, 000	5	343. 600	1 66	2, 851, 880
Rye......................................do....	80. 000	7. 3	10. 958	1 56	124. 800
Oats ....do....	1, 512, 000	10. 7	141, 308	80	1, 209, 600
Barley ....do....	5, 700	14. 6	390	1 45	8, 265
Buckwheat ....do...	....	....	....	....	....
Potatoes ....do....	227, 000	96	2, 364	1 42	322, 340
Tobacco............................pounds..	300, 000	350	857	21. 4	64, 200
Hay.......................................tons..	18, 000	1. 50	12, 000	23 06	415, 080
Total..	....	....	2, 467, 787	....	23, 735, 665

Table showing the product of each principal crop, &c.—Continued.

Product.	Amount of crop of 1871.	Average yield per acre.	Number of acres in each crop.	Value per bushel, ton, or pound.	Total valuation.
FLORIDA.					
Indian corn.....bushels..	2,022,000	10.7	188,971	$1 09	$2,203,980
Wheat.....do....	....	....	....	....	....
Rye.....do....	600	11.5	52	1 50	900
Oats.....do....	116,000	13	8,923	1 01	117,160
Barley.....do....	....	....	....	....	....
Buckwheat.....do....	....	....	....	....	....
Potatoes.....do....	9,700	73	132	1 93	18,721
Tobacco.....pounds..	....	....	....	....	....
Hay.....tons..	....	....	....	....	....
Total.....	....	....	198,078	....	2,340,761
ALABAMA.					
Indian corn.....bushels..	19,080,000	14.5	1,315,862	92	17,553,600
Wheat.....do....	832,000	6.3	132,063	1 56	1,297,920
Rye.....do....	24,000	9.2	2,608	1 80	43,200
Oats.....do....	672,000	13.4	50,149	87	584,640
Barley.....do....	6,000	15.5	387	1 10	6,600
Buckwheat.....do....	....	....	....	....	....
Potatoes.....do....	157,000	85	1,847	1 06	166,420
Tobacco.....pounds..	....	....	....	....	....
Hay.....tons..	18,600	1.33	13,984	19 50	362,700
Total.....	....	....	1,516,900	....	20,015,080
MISSISSIPPI.					
Indian corn.....bushels..	18,180,000	14	1,298,571	98	17,816,400
Wheat.....do....	198,000	10	19,800	1 59	314,820
Rye.....do....	17,800	9.2	1,934	1 70	30,260
Oats.....do....	465,000	13.8	33,695	96	446,400
Barley.....do....	3,500	16	218	1 15	4,025
Buckwheat.....do....	....	....	....	....	....
Potatoes.....do....	223,000	88	2,534	1 35	301,050
Tobacco.....pounds..	....	....	....	....	....
Hay.....tons..	15,600	1.45	10,758	21 66	337,896
Total.....	....	....	1,367,510	....	19,250,851
LOUISIANA.					
Indian corn.....bushels..	8,100,000	14.4	562,500	1 12	9,072,000
Wheat.....do....	....	....	....	....	....
Rye.....do....	1,100	11	100	1 70	1,870
Oats.....do....	39,000	20	1,950	1 12	43,680
Barley.....do....	1,200	18	66	1 16	1,392
Buckwheat.....do....	....	....	....	....	....
Potatoes.....do....	74,000	60	1,233	1 37	101,380
Tobacco.....pounds..	....	....	....	....	....
Hay.....tons..	16,000	1.50	10,666	25 00	400,000
Total.....	....	....	576,515	....	9,620,322
TEXAS.					
Indian corn.....bushels..	20,847,000	19	1,097,210	1 11	23,140,170
Wheat.....do....	551,000	11.5	47,913	1 97	1,085,470
Rye.....do....	42,000	12.1	3,471	1 65	69,300
Oats.....do....	675,000	25.1	26,892	1 04	702,000
Barley.....do....	42,000	20	2,100	1 35	56,700
Buckwheat.....do....	....	....	....	....	....
Potatoes.....do....	220,000	105	2,095	1 85	407,000
Tobacco.....pounds..	....	....	....	....	....
Hay.....tons..	22,500	1.07	21,028	24 33	547,425
Total.....	....	....	1,200,709	....	26,008,065

Table showing the product of each principal crop, &c.—Continued.

Product.	Amount of crop of 1871.	Average yield per acre.	Number of acres in each crop.	Value per bushel, ton, or pound.	Total valuation.
ARKANSAS.					
Indian corn........................bushels..	16, 250, 000	26. 7	608, 614	$0 66	$10, 725, 000
Wheat ....do....	688, 000	8. 4	81, 904	1 55	1, 066, 400
Rye.......................................do....	39, 000	12	3, 250	1 75	68, 250
Oats ....do....	657, 000	25	26, 280	73	479, 610
Barley ....do....	2, 000	21	95	1 20	2, 400
Buckwheat ....do....	....	....	....	....	....
Potatoes ....do....	427, 000	82	5, 207	1 11	473, 970
Tobacco..............................pounds..	778, 000	833	933	14. 5	112, 810
Hay.......................................tons..	12, 200	1. 67	7, 305	20 87	254, 614
Total....................................	....	....	733, 588	....	13, 183, 054
TENNESSEE.					
Indian corn........................bushels..	45, 900, 000	23	1, 995, 652	51	23, 409, 000
Wheat ....do....	5, 149, 000	5	1, 029, 800	1 28	6, 590, 720
Rye.......................................do....	208, 000	8. 4	24, 761	92	191, 360
Oats ....do....	4, 116, 000	15. 2	270, 789	46	1, 893, 360
Barley ....do...	78, 000	17. 8	4, 382	72	56, 160
Buckwheat ....do....	65, 000	8. 2	7, 926	90	58, 500
Potatoes ....do....	1, 122, 000	80	14, 025	68	762, 960
Tobacco ....pounds..	22, 750, 000	741	30, 701	11	2, 502, 500
Hay.......................................tons..	124, 000	1. 48	83. 783	16 58	2, 055, 920
Total....................................	....	....	3, 461, 819	....	37, 520, 480
WEST VIRGINIA.					
Indian corn........................bushels..	9, 345, 000	27. 6	338, 586	63	5, 887, 350
Wheat ....do....	2, 608, 000	10	260, 800	1 31	3, 416, 480
Rye.......................................do....	268, 000	13	20, 615	87	233, 160
Oats ....do....	2, 389, 000	25. 1	95, 179	44	1, 051, 160
Barley ....do....	53, 000	11	4, 818	70	37, 100
Buckwheat ....do....	65, 000	14. 1	4, 609	92	59, 800
Potatoes ....do....	980, 000	73	13, 424	66	646, 800
Tobacco..............................pounds..	2, 177, 000	605	3, 598	14. 4	313, 488
Hay.......................................tons..	193, 000	. 97	198, 969	14 58	2, 813, 940
Total....................................	....	....	940, 598	....	14, 459, 278
KENTUCKY.					
Indian corn........................bushels..	53, 843, 000	27. 3	1, 972, 271	47	25, 306, 210
Wheat ....do....	4, 488, 000	6. 1	735, 737	1 29	5, 789, 520
Rye.......................................do....	869, 000	9. 4	92, 446	81	703, 890
Oats ....do....	6, 209, 000	24. 3	255, 514	41	2, 545, 690
Barley ....do....	243, 000	22	11, 045	84	204, 120
Buckwheat ....do....	4, 000	25	160	1 25	5, 000
Potatoes ....do....	2, 124, 000	69	30, 782	78	1, 656, 720
Tobacco..............................pounds..	103, 500, 000	724	142, 955	07. 7	7, 969, 500
Hay.......................................tons..	320, 000	1. 20	266, 666	14 27	4, 566, 400
Total....................................	....	....	3, 507, 576	....	48, 747, 050
OHIO.					
Indian corn........................bushels..	89, 506, 000	38. 5	2, 324, 831	45	40, 277, 700
Wheat ....do....	18, 575, 000	13. 9	1, 336, 330	1 26	23, 404, 500
Rye.......................................do....	441, 000	14. 5	30, 413	77	339, 570
Oats ....do....	24, 990, 000	34. 7	720, 172	35	8, 746, 500
Barley ....do....	1, 593, 000	26. 1	61, 034	74	1, 178, 820
Buckwheat ....do....	243, 000	14. 5	16, 758	96	233, 280
Potatoes ....do....	8, 613, 000	96	89, 718	63	5, 426, 190
Tobacco..............................pounds..	21, 311, 000	828	25, 737	09. 1	1, 939, 301
Hay.......................................tons..	1, 730, 000	1. 22	1, 418, 032	11 91	20, 604, 300
Total....................................	....	....	6, 023, 025	....	102, 150, 161

Table showing the product of each principal crop, &c.—Continued.

Product.	Amount of crop of 1871.	Average yield per acre.	Number of acres in each crop.	Value per bushel, ton, or pound.	Total valuation.
MICHIGAN.					
Indian corn ....bushels..	16, 179, 000	32. 4	499, 351	$0 59	$9, 545, 610
Wheat ....do....	16, 205, 000	14	1, 157, 500	1 32	21, 390, 600
Rye ....do....	241, 000	14. 4	16, 736	76	183, 160
Oats ....do....	9, 634, 000	34. 2	281, 695	41	3, 949, 940
Barley ....do....	554, 0 0	23. 2	23, 879	93	515, 220
Buckwheat ....do....	405, 000	15	27, 000	79	319, 950
Potatoes ....do....	5, 950, 000	68	87, 500	83	4, 938, 500
Tobacco ....pounds..	....	....	....	....	....
Hay ....tons..	1, 030, 000	1. 12	919, 642	17 33	17, 849, 900
Total	....	....	3, 013, 303	....	58, 692, 880
INDIANA.					
Indian corn ....bushels..	79, 205, 000	35. 7	2, 218, 627	37	29, 305, 850
Wheat ....do....	19, 190, 000	12	1, 599, 166	1 26	24, 179, 400
Rye ....do....	423, 000	13. 9	30, 431	72	304, 560
Oats ....do....	11, 784, 000	28. 8	409, 166	33	3, 888, 720
Barley ....do....	352, 000	27. 4	12, 846	72	253, 440
Buckwheat ....do....	154, 000	13. 5	11, 407	75	115, 500
Potatoes ....do....	2, 436, 000	64	38, 062	82	1, 997, 520
Tobacco ....pounds..	8, 316, 000	702	11, 846	08. 5	706, 860
Hay ....tons..	826, 000	1. 19	694, 117	12 78	10, 556, 280
Total	....	....	5, 025, 608	....	71, 308, 130
ILLINOIS.					
Indian corn ....bushels..	203, 391, 000	38. 3	5, 310, 469	32	65, 085, 120
Wheat ....do....	25, 216, 000	12. 3	2, 050, 081	1 18	29, 754, 880
Rye ....do....	2, 190, 000	17. 8	123, 033	56	1, 226, 400
Oats ....do....	38, 502, 000	33. 1	1, 163, 202	28	10, 780, 560
Barley ....do....	2, 053, 000	25. 5	80, 509	52	1, 067, 560
Buckwheat ....do....	164, 000	14. 1	11, 631	74	121, 360
Potatoes ....do....	7, 162, 000	61	117, 409	85	6, 087, 700
Tobacco ....pounds..	6, 398, 000	731	8, 752	06. 6	422, 268
Hay ....tons..	1, 838, 000	1. 31	1, 403, 053	10 05	18, 471, 900
Total	....	....	10, 268, 139	....	133, 017, 748
WISCONSIN.					
Indian corn ....bushels..	21, 394, 000	37. 7	567, 480	43	9, 199, 420
Wheat ....do....	18, 436, 000	12. 2	1, 511, 147	1 11	20, 463, 960
Rye ....do....	1, 243, 000	16. 1	77, 204	60	745, 800
Oats ....do....	15, 759, 000	38. 6	408, 264	35	5, 515, 650
Barley ....do....	1, 531, 000	29. 9	51, 204	56	857, 360
Buckwheat ....do....	448, 000	18. 3	24, 480	62	277, 760
Potatoes ....do....	5, 502, 000	105	52, 400	55	3, 026, 100
Tobacco ....pounds..	1, 140, 000	1, 200	950	11	125, 400
Hay ....tons..	1, 345, 000	1. 45	927, 586	10 63	14, 297, 350
Total	....	....	3, 620, 715	....	54, 508, 800
MINNESOTA.					
Indian corn ....bushels..	8, 152, 000	37. 3	218, 552	44	3, 586, 880
Wheat ....do....	12, 016, 000	11	1, 092, 363	1 00	12, 016, 000
Rye ....do....	68, 000	16. 8	4, 047	63	42, 840
Oats ....do....	7, 883, 000	33. 8	233, 224	34	2, 680, 220
Barley ....do....	960, 000	25. 4	37, 795	46	441, 600
Buckwheat ....do....	47, 0 0	20. 7	2, 270	84	39, 480
Potatoes ....do....	1, 745, 000	123	14, 186	39	680, 550
Tobacco ....pounds..	....	....	....	....	....
Hay ....tons..	796, 000	1. 55	513, 548	6 27	4, 990, 920
Total	....	....	2, 115, 985	....	24, 478, 490

Table showing the product of each principal crop, &c.—Continued.

Product.	Amount of crop of 1871.	Average yield per acre.	Number of acres in each crop.	Value per bushel, ton, or pound.	Total valuation.
IOWA.					
Indian corn......bushels..	99,019,000	42.5	2,329,858	$0 23	$22,774,370
Wheat......do....	18,400,000	10.8	1,703,703	96	17,664,000
Rye......do....	533,000	19.9	26,783	51	271,830
Oats......do....	19,934,000	41.1	485,012	21	4,186,140
Barley......do....	2,110,000	29.6	71,283	46	970,600
Buckwheat......do....	152,000	26.7	5,692	72	109,440
Potatoes......do....	6,084,000	131	46,442	38	2,311,920
Tobacco......pounds..	75,000	750	100	08	6,000
Hay......tons..	1,632,000	1.64	995,121	6 09	9,938,880
Total......	......	......	5,663,994	......	58,233,180
MISSOURI.					
Indian corn......bushels..	87,390,000	38	2,299,736	31	27,090,900
Wheat......do....	12,825,000	13.4	957,089	1 16	14,877,000
Rye......do....	508,000	17.1	29,707	59	299,720
Oats......do....	13,812,000	28.3	488,056	30	4,143,600
Barley......do....	270,000	27.5	9,818	62	167,400
Buckwheat......do....	42,000	22.1	1,900	71	29,820
Potatoes......do....	3,410,000	78	43,717	64	2,182,400
Tobacco......pounds..	13,138,000	822	15,982	08.3	1,090,454
Hay......tons..	542,000	1.55	349,677	10 66	5,777,720
Total......	......	......	4,195,682	......	55,659,014
KANSAS.					
Indian corn......bushels..	24,693,000	40	617,325	29	7,160,970
Wheat......do....	2,694,000	15.9	169,433	1 13	3,044,220
Rye......do....	86,000	19	4,526	67	57,620
Oats......do....	4,056,000	31.8	127,547	30	1,216,800
Barley......do....	101,000	21.8	4,633	70	70,700
Buckwheat......do....	32,000	15.2	2,105	93	29,760
Potatoes......do....	3,452,000	97	35,587	69	2,381,880
Tobacco......pounds..	......	......	......	......	......
Hay......tons..	687,000	1.90	361,578	4 91	3,373,170
Total......	......	......	1,322,734	......	17,335,120
NEBRASKA.					
Indian corn......bushels..	7,228,000	41.5	174,168	25	1,807,000
Wheat......do....	1,829,000	10.3	177,572	90	1,646,100
Rye......do....	13,000	18	722	55	7,150
Oats......do....	1,226,000	31.8	38,553	25	306,500
Barley......do....	252,000	29.6	8,513	46	115,920
Buckwheat......do....	3,600	16	225	94	3,384
Potatoes......do....	922,000	124	7,435	32	295,040
Tobacco......pounds..	......	......	......	......	......
Hay......tons..	169,000	1.80	93,888	4 76	804,440
Total......	......	......	501,076	......	4,985,534
CALIFORNIA.					
Indian corn......bushels..	934,000	38	24,578	1 16	1,083,440
Wheat......do....	16,757,000	11	1,523,363	1 41	23,627,370
Rye......do....	24,900	27	922	1 40	34,860
Oats......do....	1,517,000	40	37,925	70	1,061,900
Barley......do....	7,287,000	20	364,350	1 08	7,869,960
Buckwheat......do....	21,300	26	819	1 30	27,690
Potatoes......do....	1,677,000	152	11,032	91	1,526,070
Tobacco......pounds..	......	......	......	......	......
Hay......tons..	536,000	1.29	415,503	21 85	11,711,600
Total......	......	......	2,378,492	......	46,942,890

Table showing the product of each principal crop, &c.—Continued.

Product.	Amount of crop of 1871.	Average yield per acre.	Number of acres in each crop.	Value per bushel, ton, or pound.	Total valuation.
OREGON.					
Indian corn.....bushels..	85,000	26.6	3,195	$1 00	$85,000
Wheat.....do....	2,292,000	19.2	119,375	1 04	2,383,680
Rye.....do....	3,900	25	156	95	3,705
Oats.....do....	1,773,000	29.7	59,696	77	1,365,210
Barley.....do....	206,000	29	71,034	84	173,040
Buckwheat.....do....	700	20	35	1 40	980
Potatoes.....do....	389,000	76	5,118	1 03	400,670
Tobacco.....pounds..	.....	.....	.....	.....	.....
Hay.....tons..	82,000	1.62	50,617	19 40	1,590,800
Total.....	.....	.....	309,226	.....	6,003,085
NEVADA.					
Indian corn.....bushels..	12,000	32	375	1 50	18,000
Wheat.....do....	281,000	24	11,708	1 75	491,750
Rye.....do....	.....	.....	.....	.....	.....
Oats.....do....	67,000	35	1,914	1 00	67,000
Barley.....do....	366,000	28	13,071	1 20	439,200
Buckwheat.....do....	.....	.....	.....	.....	.....
Potatoes.....do....	173,000	75	2,306	1 75	302,750
Tobacco.....pounds..	.....	.....	.....	.....	.....
Hay.....tons..	44,000	1.41	31,205	23 00	1,012,000
Total.....	.....	.....	60,579	.....	2,330,700
THE TERRITORIES.					
Indian corn.....bushels..	1,353,000	30.4	44,506	97	1,312,410
Wheat.....do....	1,976,000	22.6	87,433	1 23	2,430,480
Rye.....do....	13,900	26.4	526	1 00	13,900
Oats.....do....	1,237,000	35.6	34,747	81	1,001,970
Barley.....do....	377,000	29.2	12,910	99	373,230
Buckwheat.....do....	.....	.....	.....	.....	.....
Potatoes.....do....	875,000	127	6,889	90	787,500
Tobacco.....pounds..	.....	.....	.....	.....	.....
Hay.....tons..	128,000	1.65	77,575	15 96	2,042,880
Total.....	.....	.....	264,586	.....	7,962,370

Summary for each State, showing the product, the number of acres, and the value of each crop, for 1871.

States.	INDIAN CORN.			WHEAT.			RYE.		
	Bushels.	Acres.	Value of crop.	Bushels.	Acres.	Value of crop.	Bushels.	Acres.	Value of crop.
Maine	1, 078, 000	39, 632	$1, 056, 440	269, 000	20, 692	$484, 200	31, 000	1, 802	$36, 890
New Hampshire	1, 273, 000	35, 658	1, 209, 350	186, 000	12, 236	319, 920	44, 000	2, 378	49, 720
Vermont	1, 747, 000	49, 073	1, 729, 530	413, 000	24, 879	669, 060	67, 600	4, 225	75, 036
Massachusetts	1, 419, 000	41, 370	1, 390, 620	36, 000	1, 978	60, 480	243, 000	13, 500	272, 160
Rhode Island	308, 000	11, 282	304, 920	700	38	1, 155	20, 600	1, 051	21, 630
Connecticut	1, 624, 000	51, 719	1, 737, 680	38, 700	2, 276	59, 985	297, 000	20, 915	347, 490
New York	17, 483, 000	529, 787	14, 336, 060	9, 589, 000	557, 500	14, 479, 390	2, 341, 000	141, 024	2, 060, 080
New Jersey	10, 559, 000	293, 305	7, 919, 250	2, 100, 000	116, 666	3, 234, 000	517, 000	34, 466	485, 980
Pennsylvania	39, 254, 000	1, 105, 746	30, 225, 580	19, 339, 000	1, 193, 765	28, 041, 550	3, 336, 000	228, 493	2, 868, 960
Delaware	3, 575, 000	162, 500	2, 145, 000	688, 000	59, 826	1, 045, 760	10, 100	2, 020	7, 575
Maryland	11, 227, 000	475, 720	7, 185, 280	5, 654, 000	471, 166	8, 594, 080	287, 000	24, 956	243, 950
Virginia	19, 553, 000	865, 176	13, 100, 510	6, 369, 000	796, 125	8, 852, 910	467, 000	34, 338	331, 570
North Carolina	20, 700, 000	1, 478, 571	14, 697, 000	2, 530, 000	421, 666	3, 592, 600	320, 000	48, 484	275, 200
South Carolina	9, 840, 000	984, 000	9, 052, 800	586, 000	117, 200	1, 189, 580	46, 000	6, 478	71, 300
Georgia	20, 150, 000	1, 956, 310	18, 739, 500	1, 718, 000	343, 600	2, 851, 880	80, 000	10, 958	124, 800
Florida	2, 022, 000	188, 971	2, 203, 980	....	....	....	600	52	900
Alabama	19, 080, 000	1, 315, 862	17, 553, 600	832, 000	132, 063	1, 297, 920	24, 000	2, 608	43, 200
Mississippi	18, 180, 000	1, 298, 571	17, 816, 400	198, 000	19, 800	314, 820	17, 800	1, 934	30, 260
Louisiana	8, 100, 000	562, 500	9, 072, 000	....	....	....	1, 100	100	1, 870
Texas	20, 847, 000	1, 097, 210	23, 140, 170	551, 000	47, 913	1, 085, 470	42, 000	3, 471	69, 300
Arkansas	16, 250, 000	608, 614	10, 725, 000	688, 000	81, 904	1, 066, 400	39, 000	3, 250	68, 250
Tennessee	45, 900, 000	1, 995, 652	23, 409, 000	5, 149, 000	1, 029, 800	6, 590, 720	208, 000	24, 761	191, 360
West Virginia	9, 345, 000	338, 586	5, 887, 350	2, 608, 000	260, 800	3, 416, 480	268, 000	20, 615	233, 160
Kentucky	53, 843, 000	1, 972, 271	25, 306, 210	4, 488, 000	735, 737	5, 789, 520	869, 000	92, 446	703, 890
Ohio	89, 506, 000	2, 324, 831	40, 277, 700	18, 575, 000	1, 336, 330	23, 404, 500	441, 000	30, 413	339, 570
Michigan	16, 179, 000	499, 351	9, 545, 610	16, 205, 000	1, 157, 500	21, 390, 600	241, 000	16, 736	183, 160
Indiana	79, 205, 000	2, 218, 627	29, 305, 850	19, 190, 000	1, 599, 166	24, 179, 400	423, 000	30, 431	304, 560
Illinois	203, 391, 000	5, 316, 469	65, 085, 120	25, 216, 000	2, 050, 081	29, 754, 880	2, 190, 000	123, 033	1, 226, 400
Wisconsin	21, 394, 000	567, 480	9, 199, 420	18, 436, 000	1, 511, 147	20, 463, 960	1, 243, 000	77, 204	745, 800
Minnesota	8, 152, 000	218, 552	3, 586, 880	12, 016, 000	1, 092, 363	12, 016, 000	68, 000	4, 047	42, 840
Iowa	99, 019, 000	2, 329, 858	22, 774, 370	18, 400, 000	1, 703, 703	17, 664, 000	533, 000	26, 783	271, 830
Missouri	87, 390, 000	2, 299, 736	27, 090, 900	12, 825, 000	957, 089	14, 877, 000	508, 000	29, 707	299, 720
Kansas	24, 693, 000	617, 325	7, 160, 970	2, 694, 000	169, 433	3, 044, 220	86, 000	4, 526	57, 620
Nebraska	7, 228, 000	174, 168	1, 807, 000	1, 829, 000	177, 572	1, 646, 100	13, 000	722	7, 150
California	934, 000	24, 578	1, 083, 440	16, 757, 000	1, 523, 363	23, 627, 370	24, 900	922	34, 860
Oregon	85, 000	3, 195	85, 000	2, 292, 000	119, 375	2, 383, 680	3, 900	156	3, 705
Nevada	12, 000	375	18, 000	281, 000	11, 708	491, 750	....	....	....
The Territories	1, 353, 000	44, 506	1, 312, 410	1, 976, 000	87, 433	2, 430, 480	13, 900	526	13, 900
Total	991, 898, 000	34, 091, 137	478, 275, 900	230, 722, 400	18, 943, 893	290, 411, 820	15, 365, 500	1, 069, 531	12, 145, 646

Summary for each State, showing the product, the number of acres, and the value of each crop, for 1871—Continued.

States.	OATS.			BARLEY.			BUCKWHEAT.		
	Bushels.	Acres.	Value of crop.	Bushels.	Acres.	Value of crop.	Bushels.	Acres.	Value of crop.
Maine	1, 514, 000	60, 560	$999, 240	439, 000	20, 418	$381, 930	398, 000	18, 952	$362, 180
New Hampshire	1, 151, 000	31, 108	725, 130	97, 000	3, 299	95, 060	88, 700	4, 743	62, 977
Vermont	3, 106, 000	87, 492	1, 646, 180	108, 000	4, 736	131, 760	319, 000	15, 190	223, 300
Massachusetts	754, 000	24, 012	527, 800	123, 000	5, 082	131, 610	49, 000	3, 266	52, 430
Rhode Island	156, 000	4, 684	93, 600	30, 900	1, 343	30, 900	1, 400	87	1, 470
Connecticut	958, 000	30, 316	622, 700	23, 000	1, 045	27, 600	97, 900	4, 079	97, 900
New York	32, 610, 000	834, 015	16, 631, 100	6, 946, 000	268, 185	5, 417, 880	3, 091, 000	128, 257	2, 410, 980
New Jersey	3, 846, 000	115, 495	1, 999, 920	7, 200	276	6, 840	289, 000	18, 062	265, 880
Pennsylvania	31, 545, 000	1, 017, 580	15, 457, 050	472, 000	25, 376	424, 800	2, 050, 000	97, 156	1, 906, 500
Delaware	398, 000	19, 900	163, 180	1, 700	100	1, 360	1, 100	88	847
Maryland	2, 563, 000	144, 802	1, 230, 240	10, 900	605	9, 810	50, 000	3, 521	48, 500
Virginia	5, 381, 000	328, 109	2, 636, 690	6, 600	377	5, 280	33, 000	2, 291	27, 060
North Carolina	2, 200, 000	207, 547	1, 386, 000	1, 900	118	1, 235	14, 000	1, 206	8, 540
South Carolina	537, 000	60, 337	467, 190	4, 900	326	4, 900	....	....	....
Georgia	1, 512, 000	141, 308	1, 209, 600	5, 700	390	8, 265	....	....	....
Florida	116, 000	8, 923	117, 160	....	....	....	....	....	....
Alabama	672, 000	50, 149	584, 640	6, 000	387	6, 600	....	....	....
Mississippi	465, 000	33, 695	446, 400	3, 500	218	4, 025	....	....	....
Louisiana	39, 000	1, 950	43, 680	1, 200	66	1, 392	....	....	....
Texas	675, 000	26, 892	702, 000	42, 000	2, 100	56, 700	....	....	....
Arkansas	657, 000	26, 280	479, 610	2, 000	95	2, 400	....	....	....
Tennessee	4, 116, 000	270, 789	1, 893, 360	78, 000	4, 382	56, 160	65, 000	7, 926	58, 500
West Virginia	2, 389, 000	95, 179	1, 051, 160	53, 000	4, 818	37, 100	65, 000	4, 609	59, 800
Kentucky	6, 209, 000	255, 514	2, 545, 690	243, 000	11, 045	204, 120	4, 000	160	5, 000
Ohio	24, 990, 000	720, 172	8, 746, 500	1, 593, 000	61, 034	1, 178, 820	243, 000	16, 758	233, 280
Michigan	9, 634, 000	281, 695	3, 949, 940	554, 000	23, 879	515, 220	405, 000	27, 000	319, 950
Indiana	11, 784, 000	409, 166	3, 888, 720	352, 000	12, 846	253, 440	154, 000	11, 407	115, 500
Illinois	38, 502, 000	1, 163, 262	10, 780, 560	2, 053, 000	80, 509	1, 067, 560	164, 000	11, 631	121, 360
Wisconsin	15, 759, 000	408, 264	5, 515, 650	1, 531, 000	51, 204	857, 360	448, 000	24, 480	277, 760
Minnesota	7, 883, 000	233, 224	2, 680, 220	960, 000	37, 795	441, 600	47, 000	2, 270	39, 480
Iowa	19, 934, 000	485, 012	4, 186, 140	2, 110, 000	71, 283	970, 600	152, 000	5, 692	109, 440
Missouri	13, 812, 000	488, 056	4, 143, 600	270, 000	9, 818	167, 400	42, 000	1, 900	29, 820
Kansas	4, 056, 000	127, 547	1, 216, 800	101, 000	4, 633	70, 700	32, 000	2, 105	29, 760
Nebraska	1, 226, 000	38, 553	306, 500	252, 000	8, 513	115, 920	3, 600	225	3, 384
California	1, 517, 000	37, 925	1, 061, 900	7, 287, 000	364, 350	7, 869, 960	21, 300	819	27, 690
Oregon	1, 773, 000	59, 696	1, 365, 210	206, 000	71, 034	173, 040	700	35	980
Nevada	67, 000	1, 914	67, 000	366, 000	13, 071	439, 200	....	....	....
The Territories	1, 237, 000	34, 747	1, 001, 970	377, 000	12, 910	373, 230	....	....	....
Total	255, 743, 000	8, 365, 809	102, 570, 030	26, 718, 500	1, 177, 666	21, 541, 777	8, 328, 700	413, 915	6, 900, 268

Summary for each State, showing the product, the number of acres, and the value of each crop, for 1871—Continued.

States.	POTATOES.			TOBACCO.			HAY.		
	Bushels.	Acres.	Value of crop.	Pounds.	Acres.	Value of crop.	Tons.	Acres.	Value of crop.
Maine	7,310,000	51,478	$3,362,600				656,000	1,426,086	$17,056,000
New Hampshire	3,874,000	27,671	1,898,260	158,000	170	$30,600	535,000	551,546	12,305,000
Vermont	4,850,000	30,312	1,704,500	70,700	74	13,786	861,000	844,117	15,067,500
Massachusetts	2,428,000	19,269	1,651,040	6,917,000	4,770	1,417,985	405,000	421,875	11,988,000
Rhode Island	527,000	5,855	384,710				80,000	87,912	2,666,400
Connecticut	1,936,000	18,264	1,316,480	8,094,000	4,761	2,023,500	411,000	370,270	12,823,200
New York	26,377,000	246,514	12,660,960	2,558,000	3,893	322,308	4,221,000	3,459,836	81,971,820
New Jersey	3,935,000	40,989	2,597,100	40,400	35	7,272	403,000	310,000	10,760,100
Pennsylvania	11,749,000	104,901	6,461,950	3,392,000	2,826	515,584	2,050,000	2,204,301	42,558,000
Delaware	238,000	1,983	119,000				33,000	26,400	577,500
Maryland	1,210,000	17,042	859,100	13,069,000	20,106	1,071,658	174,000	174,000	4,473,540
Virginia	1,174,000	16,535	833,540	39,384,000	55,627	4,253,472	183,000	151,239	3,261,060
North Carolina	816,000	7,771	572,360	9,600,000	16,026	988,800	84,000	74,336	1,033,200
South Carolina	84,000	884	115,920	35,000	70	3,675	18,500	30,833	399,600
Georgia	227,000	2,364	322,340	300,000	857	64,200	18,000	12,000	415,080
Florida	9,700	132	18,721						
Alabama	157,000	1,847	166,420				18,600	13,984	362,700
Mississippi	223,000	2,534	301,050				15,600	10,758	337,896
Louisiana	74,000	1,233	104,380				16,000	10,666	400,000
Texas	220,000	2,095	407,000				22,500	21,028	547,425
Arkansas	427,000	5,207	473,970	778,000	933	112,810	12,200	7,305	254,614
Tennessee	1,122,000	14,025	762,960	22,750,000	30,701	2,502,500	124,000	83,783	2,055,920
West Virginia	980,000	13,424	646,800	2,177,000	3,598	313,488	193,000	198,969	2,813,940
Kentucky	2,124,000	30,782	1,656,720	103,500,000	142,955	7,969,500	320,000	266,666	4,566,400
Ohio	8,613,000	89,718	5,426,190	21,311,000	25,737	1,939,301	1,730,000	1,418,032	20,604,300
Michigan	5,950,000	87,500	4,938,500				1,030,000	919,642	17,849,900
Indiana	2,436,000	38,062	1,997,520	8,316,000	11,846	706,860	826,000	694,117	10,556,280
Illinois	7,162,000	117,409	6,087,700	6,398,000	8,752	422,268	1,838,000	1,403,053	18,471,900
Wisconsin	5,502,000	52,400	3,026,100	1,140,000	950	125,400	1,345,000	927,586	14,297,350
Minnesota	1,745,000	14,186	680,550				796,000	513,548	4,990,920
Iowa	6,084,000	46,442	2,311,920	75,000	100	6,000	1,632,000	995,121	9,938,880
Missouri	3,410,000	43,717	2,182,400	13,138,000	15,982	1,090,454	542,000	349,677	5,777,720
Kansas	6,452,000	35,587	2,381,880				687,000	361,578	3,373,170
Nebraska	922,000	7,435	295,040				169,000	93,888	804,440
California	1,677,000	11,032	1,526,070				536,000	415,503	11,711,600
Oregon	389,000	5,118	400,670				82,000	50,617	1,590,800
Nevada	173,000	2,306	302,750				44,000	31,205	1,012,000
The Territories	875,000	6,889	787,500				123,000	77,575	2,042,880
Total	120,461,700	1,220,912	71,836,671	263,196,100	350,769	25,901,421	22,239,400	19,009,052	351,717,035

A general summary, showing the estimated quantities, number of acres, and aggregate value of the principal crops of the farm in 1871.

Products.	Number of bushels.	Number of acres.	Value.
Indian corn	991, 898, 000	34, 091, 137	$478, 275, 900
Wheat	230, 722, 400	19, 943, 893	290, 411, 820
Rye	15, 365, 500	1, 069, 531	12, 145, 646
Oats	255, 743, 000	8, 365, 809	102, 570, 030
Barley	26, 718, 500	1, 177, 666	21, 541, 777
Buckwheat	8, 328, 700	413, 915	6, 900, 268
Potatoes	120, 461, 700	1, 220, 912	71, 836, 671
Total	1, 649, 237, 800	66, 282, 863	983, 682, 112
Tobacco ... pounds	263, 196, 100	350, 769	$25, 901, 421
Hay ... tons	22, 239, 400	19, 009, 052	351, 717, 035
Cotton ... bales	3, 100, 000	7, 378, 000	288, 300, 000
Total	....	....	....

Table showing the average yield and cash value and price per bushel, ton, or pound of farm products for the year 1871.

Products.	Average yield per acre.	Average price per bushel.	Average value per acre.	Products.	Average yield per acre.	Average price pr. bush., ton, or pound.	Average value per acre.
Indian corn ... bush	29. 1—	$0 48. 2+	$14 02	Buckwheat ... bush	20. 1 +	$0 82. 8+	$16 67
Wheat ... do	11. 5+	1 25. 8+	14 56	Potatoes ... do	98. 6 +	59. 6+	58 83
Rye ... do	14. 3+	79. 0+	11 35	Tobacco ... lbs	750. +	09. 8+	73 84
Oats ... do	30. 5+	40. 1+	12 26	Hay ... tons	1. 17—	15 81. 5+	18 50
Barley ... do	22. 6+	80. 6+	18 29	Cotton ... lbs	195. 3	20	39 06

Table showing the average yield per acre and price per bushel, pound, or ton, of farm products for the year 1871.

States.	CORN.		WHEAT.		RYE.		OATS.		BARLEY.		BUCKWHEAT.		POTATOES.		TOBACCO.		HAY.	
	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Pounds.	Price per pound.	Tons.	Price per ton.
Maine	27.2	$0 98	13.	$1 80	17.2	$1 19	25.	$0 66	21.5	$0 87	21.	$0 91	142	$0 46	......	......	.46	$26 00
New Hampshire	35.7	95	15.2	1 72	18.5	1 13	37.	63	29.4	98	18.7	71	140	49	900	$0 20.	.97	23 00
Vermont	35.6	99	16.6	1 62	16.	1 11	35.5	53	22.8	1 22	21.	70	160	37	950	19.5	1.02	17 50
Massachusetts	34.3	98	18.2	1 68	18.	1 12	31.4	70	24.2	1 07	15.	1 07	126	68	1,450	20.5	.96	29 60
Rhode Island	27.3	99	18.	1 65	19.6	1 05	33.3	60	23.	1 00	16.	1 05	90	73	......	......	.91	33 33
Connecticut	31.4	1 07	17.	1 55	14.2	1 17	31.6	65	22.	1 20	24.	1 00	106	68	1,700	25.	1.11	31 20
New York	33.	82	17.2	1 51	16.6	88	39.1	51	25.9	78	24.1	78	107	48	657	12.6	1.22	19 42
New Jersey	36.	75	18.	1 54	15.	94	33.3	52	26.	95	16.	92	96	66	1,150	18.	1.30	26 70
Pennsylvania	35.5	77	16.2	1 45	14.6	86	31.	49	18.6	90	21.1	93	112	55	1,200	15.2	.93	20 76
Delaware	22.	60	11.5	1 52	5.	75	20.	41	17.	80	12.5	77	120	50	......	......	1.25	17 50
Maryland	23.6	64	12.	1 52	11.5	85	17.7	48	18.	90	14.2	97	71	71	650	8.2	1	25 71
Virginia	22.6	67	8.	1 39	13.6	71	16.4	49	17.5	80	14.4	82	71	71	708	10.8	1.21	17 82
North Carolina	14.	71	6.	1 42	6.6	86	10.6	63	16.	65	11.6	61	105	71	599	10.3	1.13	12 30
South Carolina	10.	92	5.	2 03	7.1	1 55	8.9	87	15.	1 00	......	......	95	1 38	500	10.5	.60	21 60
Georgia	10.3	93	5.	1 66	7.3	1 56	10.7	80	14.6	1 45	......	......	96	1 42	350	21.4	1.50	23 06
Florida	10.7	1 09	......	......	11.5	1 50	13.	1 01	......	......	......	......	73	1 93	......	......	......	......
Alabama	14.5	92	6.3	1 56	9.2	1 80	13.4	87	15.5	1 10	......	......	85	1 06	......	......	1.33	19 50
Mississippi	14.	98	10.	1 59	9.2	1 70	13.8	96	16.	1 15	......	......	88	1 35	......	......	1.45	21 66
Louisiana	14.4	1 12	......	......	11.	1 70	20.	1 12	18.	1 16	......	......	60	1 37	......	......	1.50	25 00
Texas	19.	1 11	11.5	1 97	12.1	1 65	25.1	1 04	20.	1 35	......	......	105	1 85	......	......	1.07	24 33
Arkansas	26.7	66	8.4	1 55	12.	1 75	25.	73	21.	1 20	......	......	82	1 11	833	14.5	1.67	20 87
Tennessee	23.	51	5.	1 28	8.4	92	15.2	46	17.8	72	8.2	90	80	68	741	11.	1.48	16 58
West Virginia	27.6	63	10.	1 31	13.	87	25.1	44	11.	70	14.1	92	73	66	605	14.4	.97	14 58
Kentucky	27.3	47	6.1	1 29	9.4	81	24.3	41	22.	84	25.	1 25	69	78	724	7.7	1.20	14 27
Ohio	38.5	45	13.9	1 26	14.5	77	34.7	35	26.1	74	14.5	96	96	63	828	9.1	1.22	11 91
Michigan	32.4	59	14.	1 32	14.4	76	34.2	41	23.2	93	15.	79	68	83	......	......	1.12	17 33
Indiana	35.7	37	12.	1 26	13.9	72	28.8	33	27.4	72	13.5	75	64	82	702	8.5	1.19	12 78
Illinois	38.3	32	12.3	1 18	17.8	56	33.1	28	25.5	52	14.1	74	61	85	731	6.6	1.31	10 05
Wisconsin	37.7	43	12.2	1 11	16.1	60	38.6	35	29.9	56	18.3	62	105	55	1,200	11.	1.45	10 63
Minnesota	37.3	44	11.	1 00	16.8	63	33.8	34	25.4	46	20.7	84	123	39	......	......	1.55	6 27
Iowa	42.5	23	10.8	96	19.9	51	41.1	21	29.6	46	26.7	72	131	38	750	8.	1.64	6 09
Missouri	38.	31	13.4	1 16	17.1	59	28.3	30	27.5	62	22.1	71	78	64	822	8.3	1.55	10 66
Kansas	40.	29	15.0	1 13	19.	67	31.8	30	21.8	70	15.2	93	97	69	......	......	1.90	4 91
Nebraska	41.5	25	10.3	90	18.	55	31.8	25	29.6	46	16.	94	124	32	......	......	1.80	4 76
California	38.	1 16	11	1 41	27.	1 40	40.	70	20	1 08	26.	1 30	152	91	......	......	1.29	21 85
Oregon	26.6	1 00	19.2	1 04	25.	95	29.7	77	29.	84	20.	1 40	76	1 03	......	......	1.62	19 40
Nevada	32.	1 50	24.	1 75	......	......	35.	1 00	28.	1 20	......	......	75	1 75	......	......	1.41	23 00
The Territories	30.4	97	22.6	1 23	26.4	1 00	35.6	81	29.2	99	......	......	127	90	......	......	1.65	15 96

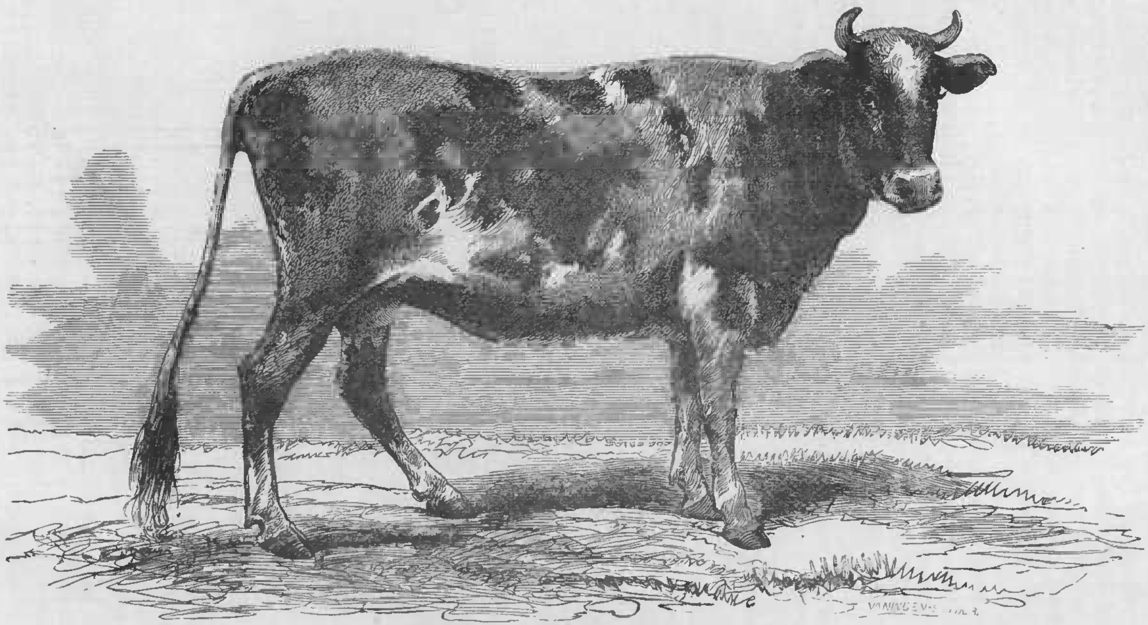
Table showing the average cash value of farm products per acre for the year 1871.

States.	Corn.	Wheat.	Rye.	Oats.	Barley.	Buckwheat.	Potatoes.	Tobacco.	Hay.
Maine	$26 65	$23 40	$20 46	$16 50	$18 70	$19 11	$65 32	....	$11 96
New Hampshire	33 91	26 14	20 90	23 31	28 81	13 27	68 60	$180 00	22 31
Vermont	35 24	26 89	17 76	18 81	27 81	14 70	59 20	185 25	17 85
Massachusetts	33 61	30 57	20 16	21 98	25 89	16 05	85 68	297 25	28 41
Rhode Island	27 02	29 70	20 58	19 98	23 00	16 80	65 70	....	30 33
Connecticut	33 59	26 35	16 61	20 54	26 40	24 00	72 08	425 00	34 63
New York	27 06	25 97	14 60	19 94	20 20	18 79	51 36	82 78	23 69
New Jersey	27 00	27 72	14 10	17 31	24 70	14 72	63 36	207 00	34 71
Pennsylvania	27 33	23 49	12 55	15 19	16 74	19 62	61 60	182 40	19 30
Delaware	13 20	17 48	3 75	8 20	13 60	9 62	60 00	....	21 87
Maryland	15 10	18 24	9 77	8 49	16 20	13 77	50 41	53 30	25 71
Virginia	15 14	11 12	9 65	8 03	14 00	11 80	50 41	76 46	21 56
North Carolina	9 94	8 52	5 67	6 67	10 40	7 07	74 55	61 69	13 89
South Carolina	9 20	10 15	11 00	7 74	15 00	....	131 10	52 50	12 96
Georgia	9 57	8 30	11 38	8 56	21 17	....	136 32	74 90	34 59
Florida	11 66	....	17 25	13 13	....	....	140 89	....	....
Alabama	13 34	9 82	16 56	11 65	17 05	....	90 10	....	25 93
Mississippi	13 72	15 90	15 64	13 24	18 40	....	118 80	....	31 40
Louisiana	16 12	....	18 70	22 40	20 88	....	82 20	....	37 50
Texas	21 09	22 65	19 96	26 10	27 00	....	194 25	....	26 03
Arkansas	17 62	13 02	21 00	18 25	25 20	....	91 02	120 78	34 85
Tennessee	11 73	6 40	7 72	6 99	12 81	7 38	54 40	81 51	24 53
West Virginia	17 38	13 10	11 31	11 04	7 70	12 97	48 18	87 12	14 14
Kentucky	12 83	7 86	7 61	9 96	18 48	31 25	53 82	55 74	17 12
Ohio	17 32	17 51	11 16	12 14	19 31	13 92	60 48	75 34	14 53
Michigan	19 11	18 48	10 94	14 02	21 57	11 85	56 44	....	19 40
Indiana	13 20	15 12	10 60	9 50	19 72	10 12	52 48	59 67	15 20
Illinois	12 25	14 51	9 96	9 26	13 26	10 43	51 85	48 24	13 16
Wisconsin	16 21	13 54	9 66	13 51	16 74	11 34	57 75	132 00	15 41
Minnesota	16 41	11 00	10 58	11 49	11 68	17 38	47 97	....	9 71
Iowa	9 77	10 36	10 14	8 63	13 61	19 22	49 78	60 00	9 98
Missouri	11 78	15 54	10 08	8 49	17 05	15 69	49 92	68 22	16 52
Kansas	11 60	17 96	12 73	9 54	15 26	14 13	66 93	....	9 32
Nebraska	10 37	9 27	9 90	7 95	13 61	15 04	39 68	....	8 56
California	44 08	15 51	37 80	28 00	21 60	33 80	138 32	....	28 18
Oregon	26 60	19 96	23 75	22 86	24 36	28 00	78 28	....	31 42
Nevada	48 00	42 00	....	35 00	33 60	....	131 25	....	32 43
The Territories	29 48	27 79	26 40	28 83	28 90	....	114 30	....	26 33

Total average cash value per acre.

States.	Average value per acre.	States.	Average value per acre.
Maine	$14 47	Texas	$21 06
New Hampshire	24 96	Arkansas	17 97
Vermont	20 14	Tennessee	10 83
Massachusetts	32 68	West Virginia	15 37
Rhode Island	31 22	Kentucky	13 89
Connecticut	37 83	Ohio	16 95
New York	24 36	Michigan	19 47
New Jersey	29 35	Indiana	14 18
Pennsylvania	21 48	Illinois	12 95
Delaware	14 88	Wisconsin	15 05
Maryland	17 80	Minnesota	11 56
Virginia	14 80	Iowa	10 28
North Carolina	10 00	Missouri	13 26
South Carolina	9 41	Kansas	13 10
Georgia	9 61	Nebraska	9 94
Florida	11 81	California	19 73
Alabama	13 19	Oregon	19 41
Mississippi	14 07	Nevada	38 47
Louisiana	16 68	The Territories	30 09

PLATE II.



JERSEY COW, "LE GALLAIS' FANCY."

Imported in 1870; three years old. [Herd Book, 1265.] The property of Thomas S. Kennedy, Fair View, near Louisville, Ky.

CONDITION OF FARM ANIMALS.

Disease has not cut off an unusual number of farm animals during the past year. Where cattle are most valuable, whatever the rigors of the climate or local scarcity of feed, the loss by disease is comparatively small, by reason of the care, which is found, by long and bitter experience, to be profitable. A large proportion of the losses reported is the result of neglect, exposure, and insufficient or innutritious pasturage or other feed. Some mortality and much reduction of flesh result from the inhuman practices of drovers, with the aid or abetting of transportation companies. Several deaths are reported at Alleghany City, resulting from the barbarous practice of stuffing animals with salted feed to induce them to drink largely for the purpose of making good upon the scales the depreciation in weight occasioned by the deprivation and suffering of the passage by rail. The occurrence of "murrain," "hollow-horn," and diseases reported by various meaningless names, so common in the Southern States, where cattle are left to the tender mercies of a rigorous winter and dried stalks of coarse grasses, might be avoided in a large measure by adequate attention to necessary supplies and protection. (1871–'72.)

The rigors of the past winter have proved conclusively the necessity of protection, not only in the more northern of the Southern States, but in Texas, where large numbers of cattle, amounting to hundreds of thousands, have succumbed to the combined agencies of cold and starvation. The pretense that shelter is unnecessary on the elevated plains of Colorado and Wyoming is also exploded, large losses, especially of Texas cattle, having occurred during the past winter. It is true that small herds, and in some cases large ones, have been sheltered in the cañons and in the lee of banks of streams, and wintered with little loss; but it is unmerciful and untrue to assert that no provision for shelter is or will be necessary in those elevated pasture-grounds of the plains and Rocky Mountains.

Diseases of horses.—Horses have suffered less than in some previous years. Cases of the various forms of disease reported have generally been isolated. Lung fever, pneumonia, staggers, and glanders have occurred only in isolated cases. "Charbon," or malignant carbuncle, is reported in Phillips County, Arkansas. A few cases of sudden death, sometimes of a farmer's whole stock, have occurred from unknown causes. Several horses died of a new disease in Dickinson County, Kansas, the symptoms of which are as follows: "Cough, yellow matter running from the nose, swelling of the throat, increasing weakness, and death. It is not distemper or glanders; veterinary surgeons do not know what to do with it, nor what it is." During May and June, 1871, a fatal malady was developed among the horses used by the different street railroad companies of New York, and extended its ravages also to the horses owned by hackmen and truckmen. Horses used to work, but kept on highly nutritious food, and suddenly put to hard work after a period of repose, were especially liable to the disease. At first the animal stumbled with his hind legs, which became shaky and difficult of movement. The hind pasterns became infirm; the joints between the upper pasterns and the shanks bent forward, in some cases breaking down, the animal finally becoming unable to stand, and remaining in a lying posture. All the muscular movements dependent upon nerves radiating from the spinal column, behind the dorsal vertebræ, were gradually paralyzed. When the horse lost power to move his tail or to retain his evacuations, the case was considered hopeless.

Prior to that point a cure was not impossible. Removal to comfortable quarters, placing the food within easy reach, and perfect quiet were found generally effective. Where fever was low it was not adjudged necessary to use drastic medicines. Fever was removed by counter-irritants, especially strong fly-blisters. The disease seriously affected the efficiency of the railway companies for several weeks.

Diseases of cattle.—A few cases of that singular climatic disease, splenic fever, (Texas cattle disease,) are reported. The same distinctive features mark every outbreak. New evidences that its germ originates in the miasmatic or tide-water region, not only in Texas, but in all the coast-lands from Texas to Virginia, accumulate yearly. Our correspondent in Fluvanna County, Virginia, (north of the James River, between Richmond and Lynchburgh,) thus writes:

There are some strange facts connected with the cattle disease common to the lower tide-water counties of Virginia, known commonly as murrain, bloody urine, or distemper, which may throw some light upon the Spanish fever following in the track of Texas cattle. In certain districts of this State murrain has always prevailed in certain seasons, attacking most frequently young and fat cattle of both sexes. It is well understood that if cows are removed from Upper Virginia to Richmond, or the lower counties, they are very apt to die the first year, whereas cattle brought from the lower counties up to Richmond escape. For this reason milk cows, brought from Gloucester and other lower counties, are much preferred by Richmond buyers; yet, in Gloucester, I have known seven cows out of ten to die of murrain in one fall. Again, throughout certain counties on the south side of the James River, extending to the North Carolina line, cattle are subject to murrain, while in other counties, directly abreast of them, on the north side of the river, the disease is unknown, unless communicated by cattle brought from the south side, that in some way infect them, while those from the south side keep well. There seems, then, to be some inherent taint in the constitution of cattle living in certain regions, which may be communicated by contact, and this, while in some cases traceable to climate, in others exists when we can discover no difference in climate. A long acquaintance with Texan cattle introduced into Louisiana warrants the opinion that they neither die themselves of this disease nor communicate it to the native herds in Louisiana.

The fact that Texas cattle do not communicate the disease to Louisiana stock is well known, and the reason is obvious, viz: Both sections are miasmatic. The coast cattle do not communicate splenic fever to other coast cattle, but to herds above tide-water. The fact is indisputable that cattle of the tide-water counties of Virginia, the Carolinas, Georgia, Florida, and other States on the Gulf coast, do communicate a fatal disease to stock of higher elevations and more salubrious climate, and that this disease has very marked and distinguishing symptoms and peculiarities which are almost invariable.

A correspondent in Murray County, Georgia, writes of a disease which he thinks, from *post-mortem* examination, presented "well-marked and clearly-defined cases of splenic fever." He says it has broken out each summer since 1865, and continues till frost. He does not describe its attendant circumstances and symptoms or say whether its advent was heralded by the coming of coast cattle. It may, therefore, or may not, be the veritable splenic fever. Murray County lies in the northwest corner of the State, toward Chattanooga, and appears to have a climate in which the splenic contagion might take. In Gilmer, an adjoining county, are reported "a few cases of Spanish (splenic) fever among cattle brought from more southern latitudes." If the true splenic fever, this must be misreported, and must refer to native cattle found "among cattle brought from more southern latitudes."

In Knox County, Tennessee, this disease prevailed last summer, mainly among milk cows exposed to contact with Texas cattle, at a point where they were fed in their passage to Virginia.

In Lincoln County, Kentucky, in February, 1871, thirty-five Texas

cattle were pastured with native stock. In July the latter began to sicken with Texas fever, and about twenty died. The Texans fattened and did well.

In Logan County, Illinois, seventy-five Texan cattle were placed in pasture with two hundred natives, mostly three-year-old steers; thirty-four head of the latter died of the fever. A drove in Cass County lost seven that had contracted the disease by being shipped from Kansas in cars in which Texas cattle had been carried. In Scott County several deaths from Spanish fever are reported.

In Taney County, Missouri, twelve animals were attacked with splenic fever; only one recovered.

The disease has existed in Kansas more than elsewhere, on account of exposure to cattle from Texas. In the northeastern part of Sedgwick county, where Texas cattle were pastured to the utmost capacity of the "range," many of the native cattle died. In other portions of the county, in which Texan cattle also ranged, the loss was small. Only native cattle were attacked, the improved breeds suffering most and the scrubs least. In the southern part of Neosho, where Texan cattle were pastured, native cattle took the disease merely by crossing the track of the Texans. In Morris the loss by splenic fever was 25 per cent.; some farmers lost all their native stock. The loss in Marion, heavy; in Lyons, 5 per cent.; in Montgomery, 10 per cent., but no case occurred among cattle in inclosures; in Allen, one hundred head; in Labette, where the stringent law against the movement of Texas cattle was evaded by driving across the border at night, many cattle in the vicinity of their trail were attacked, and three-fourths of the number died. In Dickinson and Washington several cases occurred. A drove of Texans passed through the southeastern part of Woodson in August, and in about two weeks the disease broke out among the native cattle with fatal effect.

The following is an account of the breaking out of this disease in a high latitude:

Fort Randall, Todd County, Dakota.—An outbreak of "splenic or periodic fever" among beef-cattle (about two hundred head) at this post commenced in May, 1871, when ten deaths occurred; in June, six; in July, ten; in August, twenty-two; and in September, three. The epidemic reached its acme about the middle of July. The total number of deaths in two hundred head of cattle was fifty-one. Mode of invasion, rapidity of course of disease, and death occurring at an early period, together with *post-mortem* appearances, prove conclusively that it was "splenic fever," the affection described by Professor John Gamgee in the report of the Agricultural Department. It is highly probable that the cattle, arriving here in two different lots, have had the disease communicated to them by passing over, or having been herded in, sections previously traveled over by droves of Texas cattle *en route* to supply the various Indian agencies along the Missouri river.

The disease is reported by correspondents in Benton, Prairie, and Independence Counties, Arkansas.

Independence County, Arkansas.—Spanish fever has not been seen for three years past—that is, since the law was passed prohibiting the passage of Texas cattle through the State—until last June, when five wagons from Texas, drawn by twenty yoke of oxen, passed northward on one of our principal roads, camping a day or two in a place, and their cattle allowed to graze near the road; and, strange as it may seem, fever attacked our own cattle at each of these camping places within this county, and probably one hundred of these cases proved fatal. Those in pastures, having no access to these places, were not attacked. The infection seemed to lose its influence in about thirty days after the passage of the Texas oxen. I am not able to give the actual loss in this county at that time. It was probably between one hundred and one hundred and fifty head.

Several cases are reported in Nemaha, Nebraska; and heavy losses in Santa Clara, California, are imputed to splenic fever; but the facts are not sufficient to identify the disease as splenic fever.

Pleuro-pneumonia.—A dozen cases of this disease have occurred in Ocean County, New Jersey. It was treated by bleeding, blistering, the use of carbolic acid about the stalls, of aperients and diaphoretics. In Burlington County the county agricultural society, at its annual meeting, appointed a committee to urge the State legislature to devise measures for the extermination of the disease, which had a foot-hold in that vicinity. The disease has prevailed to some extent in Baltimore County, Maryland, principally in the vicinity of Baltimore City, the heaviest losses generally occurring where the cows are kept in close, filthy stables. At Chadd's Ford, Pennsylvania, a few cases have occurred.

Epizootic aphthæ.—"The foot and mouth disease," recently introduced from Europe, is not reported as prevailing at any point at the present time. In the early part of 1871 it still lingered at several points in New England, as the vicinity of Providence, Rhode Island, and Litchfield, Connecticut. The infection came to the latter point from Albany, but animals infected were kept isolated, and the disease spread very little.

Abortion is reported in fewer instances than usual, principally in Connecticut, New York, and New Jersey.

A singular disease has prevailed extensively in Santa Cruz County, California. A local committee was appointed to investigate concerning it. The first symptoms appear to be an itching, with a desire to rub some portion of the body, the friction momentarily allaying the torment, which soon returns with increased violence until skin and hair are rubbed off; the animal becomes frantic, and dies in a period varying from eight to twenty-four hours after the first symptoms have shown themselves. Sometimes they bleed to death. But little derangement of the secretions is noticeable. There is no fever, and the circulation at first is normal, becoming weaker and more rapid toward the last. Several *post-mortem* examinations of cattle dying of this disease were made, but without satisfactory results, as each case seemed to present different features. Mr. R. McClure, veterinary surgeon, of Philadelphia, attributes the disease to entozoic parasites taken into the stomach from the grass in the form of *ova* of these parasites.

Obscurely characterized diseases, classed as "distemper," "murrain," and by other names, have caused considerable loss in all parts of the country, but more especially in the tide-water lands of the South.

Diseases of sheep.—Sheep appear to have suffered less from disease the past year than usual. The sickly and neglected animals had been quite thoroughly culled, and the flocks have been in better condition. The easily discouraged and changeable flock-masters have left the business, assigning flocks to more judicious men, who know that the time to enter a business is when it has reached its lowest ebb.

Foot-rot and scab are widely distributed, as to territory, but do not generally involve a large percentage of flocks, nor are they attended with great mortality. The heaviest losses occur in distant States, which have received large numbers of the flocks of other States. In Barton County, Missouri, which had thus received large flocks, it is estimated that scarcely five hundred remain, in consequence of the prevalence of scab and other diseases. Grub in the head has not been widely prevalent.

Diseases of swine.—As usual, the fatality is greatest among swine, of all the domestic animals. The heaviest loss appears in the South and West, the percentage of loss ranging from 5 up to 60 per cent., though in many counties no material losses are reported. In Scott,

County, Virginia, the loss is one-third of the stock; in Caldwell County, North Carolina, 25 per cent.; in Columbia County, 50; in Austin, Texas, 25; in Obion and Humphreys, Tennessee, 24; in Hardin and Christian, Kentucky, 33; 25 in Pendleton, and 20 in Meade and Ohio; in Berkeley, West Virginia, 60; in Illinois, Sangamon, and Wayne, 20, 25 in Clinton, and 30 in Scott; in Chariton, Missouri, 40, and in Audrain 20; in Warren and Lucas, Iowa, 20. These are the worst cases reported. Others are sufficiently discouraging. In Jefferson, West Virginia, more than five thousand died, valued at $25,000. Almost entire stocks of individual farmers or distillers were swept away in some counties in which disease was not general. Remedies appear to avail little; prevention, by cleanliness, release from restraint of pens, and the use of salt, tar, coal, ashes, sulphur, &c., have numerous testimonials of efficacy.

Wintering of cattle.—The scarcity of hay has interfered with the winter condition of stock in some portions of New England, but the deficiency has been generally supplied with corn or other feed. More grain than usual has been fed in the Middle States, and, with a few exceptions, cattle wintered well in the South. The severity of winter storms, combined in some sections with short feed, resulting from the drought of summer or autumn, has caused greater losses than usual.

In Western Texas, where the drought has been severe and long-continued, the plains are strewn with the bones of dead cattle, and hundreds of thousands of hides are in the hands of dealers for shipment. Losses have been heavy in Kansas and Nebraska, especially among herds of Texas cattle left to winter there. While heavy losses have been reported from Northern Colorado and Wyoming, it is evident that cattle have wintered better throughout the upper plains and among the Rocky Mountains, than in Texas or in the Missouri Valley.

The grasses, dwarfed and unusually dry in some localities from the droughts of last summer, are more nutritious than those of moister climates. All the reports from Dakota are favorable; some representing stock to be in better order than last spring, "notwithstanding the extreme cold." The stock of the Indian Territory is reported comparatively poor, but generally healthy. Colorado and Wyoming have experienced a very severe winter, "the severest ever known," as some report, with much snow covering the grasses of the plains, and driving herds to the bare foot-hills, often crowding the range and threatening starvation; yet there are herds in these Territories that are in good condition, having suffered little loss. From El Paso County, Colorado, which has a very high elevation, the report is "fine condition, better than last year." The winter has tested the reliability of this region for winter stock-feeding, and proves that a limited number, with proper attention, suitable natural or artificial protection, and feeding in storms or heavy snows, can be cheaply kept, with as good a prospect of immunity from suffering or loss as in almost any other section of the country. In New Mexico the winter has been exceptionably favorable for stock-raisers, and almost equally advantageous in Utah; only in Summit County are cattle "generally poor, the winter being unusually wet and stormy." The severe droughts in Arizona, for two or three seasons past, have interfered sadly with the condition of stock in that Territory. In Montana cattle are thin, but healthy; and in Washington they are generally in fine order, as also in Nevada, and in Oregon, except where entirely neglected. In South California the drought of last season left little feed for winter, and cattle suffered much in the early part of the season. Favorable returns come from Plumas, Santa Clara, Del Norte, Lake, Mendocino, Tuolumne, and most of the northern counties.

Table showing the estimated total number and total value of each kind of live stock, and the average price in February, 1872.

States.	Horses.			Mules.			Oxen and other cattle.		
	Number.	Average price.	Value.	Number.	Average price.	Value.	Number.	Average price.	Value.
Maine	78, 800	$79 04	$6, 228, 352	....	....	....	149, 100	$24 29	$3, 621, 639
New Hampshire	47, 500	79 04	3, 754, 400	....	....	....	117, 000	30 68	3, 589, 560
Vermont	71, 000	95 08	6, 750, 680	....	....	....	130, 700	31 70	4, 143, 190
Massachusetts	101, 800	113 33	11, 536, 994	....	....	....	120, 200	35 21	4, 232, 242
Rhode Island	14, 900	91 86	1, 368, 714	....	....	....	17, 100	40 38	690, 498
Connecticut	50, 900	96 84	4, 929, 156	....	....	....	117, 100	38 43	4, 500, 153
New York	659, 300	99 04	65, 297, 072	19, 100	$119 87	$2, 289, 517	697, 900	34 10	23, 798, 390
New Jersey	116, 900	129 10	15, 091, 790	14, 900	149 95	2, 234, 255	85, 700	37 75	3, 235, 175
Pennsylvania	546, 100	97 18	53, 069, 998	24, 900	130 21	3, 242, 229	722, 800	31 01	22, 414, 028
Delaware	20, 000	75 82	1, 516, 400	4, 000	113 99	455, 960	33, 400	18 16	606, 544
Maryland	103, 500	91 14	9, 432, 990	10, 800	122 97	1, 328, 076	126, 900	21 84	2, 771, 496
Virginia	183, 800	78 18	14, 369, 484	29, 400	110 42	3, 246, 348	405, 700	17 21	6, 982, 097
North Carolina	130, 500	90 54	11, 815, 470	45, 700	111 02	5, 073, 614	307, 300	10 45	3, 211, 285
South Carolina	54, 800	94 86	5, 198, 328	43, 900	112 69	4, 947, 091	179, 600	13 37	2, 401, 252
Georgia	115, 000	97 33	11, 192, 950	90, 900	121 99	11, 088, 891	401, 300	10 23	4, 105, 299
Florida	16, 800	93 52	1, 571, 136	10, 400	125 26	1, 302, 704	395, 500	8 20	3, 243, 100
Alabama	106, 700	87 14	9, 297, 838	101, 600	105 83	10, 752, 328	337, 800	11 39	3, 847, 542
Mississippi	83, 400	91 71	7, 648, 614	97, 200	113 74	11, 055, 528	340, 100	13 52	4, 598, 152
Louisiana	72, 200	85 38	6, 164, 436	76, 200	116 55	8, 881, 110	177, 700	12 70	2, 256, 790
Texas	640, 300	33 31	21, 328, 393	87, 000	48 34	4, 205, 580	3, 123, 400	8 10	25, 299, 540
Arkansas	147, 700	78 81	11, 640, 237	76, 700	97 36	7, 467, 512	235, 200	12 21	2, 871, 792
Tennessee	291, 200	82 73	24, 090, 976	98, 300	95 10	9, 348, 330	348, 200	13 88	4, 833, 016
West Virginia	99, 700	72 32	7, 210, 304	2, 300	85 91	197, 593	233, 200	24 78	5, 778, 696
Kentucky	337, 200	69 91	23, 573, 652	83, 700	78 40	6, 562, 080	400, 400	25 99	10, 406, 396
Ohio	738, 600	78 15	57, 721, 590	22, 400	83 44	1, 869, 056	850, 000	29 50	25, 075, 000
Michigan	282, 700	77 80	21, 994, 060	4, 000	87 98	351, 920	459, 000	28 45	13, 058, 550
Indiana	663, 000	66 78	44, 275, 140	35, 300	68 66	2, 423, 698	750, 000	22 26	16, 695, 000
Illinois	1, 028, 900	65 81	67, 711, 909	96, 900	80 63	7, 813, 047	1, 236, 200	22 58	27, 913, 396
Wisconsin	328, 800	76 19	25, 051, 272	5, 000	89 99	449, 950	419, 500	26 56	11, 141, 920
Minnesota	131, 800	76 55	10, 089, 290	2. 900	88 39	256, 331	251, 700	22 20	5, 587, 740
Iowa	616, 000	66 01	40, 662, 160	35, 700	74 50	2, 659, 650	871, 900	21 44	18, 693, 536
Missouri	511, 900	53 14	27, 202, 366	87, 500	73 33	6, 416, 375	767, 600	17 94	13, 770, 741
Kansas	180, 900	58 91	10, 656, 819	16, 300	76 52	1, 247, 276	397, 400	20 97	8, 333, 478
Nebraska	43, 400	72 02	3, 125, 668	4, 000	97 74	390, 960	65, 400	24 38	1, 594, 452
California	202, 700	43 59	8, 835, 693	20, 500	59 76	1, 225, 080	465, 500	23 80	11, 078, 900
Oregon	78, 500	47 68	3, 742, 880	4, 300	54 49	234, 307	109, 100	23 23	2, 534, 393
Nevada	9, 400	44 40	417, 360	1, 000	56 66	56, 660	32, 000	25 26	808, 320
The Territories	84, 300	49 15	4, 143, 345	23, 500	83 16	1, 954, 260	511, 200	23 16	11, 839 392
Total	8, 990, 900	....	659, 707, 916	1, 276, 300	....	121, 027, 316	16, 389, 800	....	321, 562, 693
Grand average of prices	....	73 37	....	....	94 82	....	....	19 61	....

Table showing the estimated total number and total value of each kind of live stock, and the average price in February, 1872—Continued.

States.	MILCH COWS.			SHEEP.			HOGS.		
	Number.	Average price.	Value.	Number.	Average price.	Value.	Number.	Average price.	Value.
Maine	117,200	$25 13	$2,945,236	348,600	$3 08	$1,073,688	61,500	$9 99	$614,385
New Hampshire	88,300	33 33	2,943,039	219,900	2 93	644,307	43,400	11 68	506,912
Vermont	191,900	36 62	7,027,378	580,800	4 26	2,474,208	61,300	9 52	583,576
Massachusetts	140,600	39 87	5,605,722	66,900	3 51	234,819	80,500	11 85	953,925
Rhode Island	21,000	41 33	867,930	27,900	3 62	100,998	18,500	10 49	194,065
Connecticut	107,900	43 10	4,650,490	79,300	4 28	339,404	65,100	11 63	757,113
New York	1,425,200	39 53	56,338,156	2,059,200	4 02	8,277,984	678,500	7 34	4,980,190
New Jersey	147,900	54 80	8,104,920	122,300	5 08	621,284	171,600	9 66	1,657,656
Pennsylvania	788,900	39 16	30,893,324	1,674,300	3 41	5,709,363	1,099,900	6 67	7,336,333
Delaware	26,000	32 00	832,000	25,300	4 00	101,200	46,000	5 00	230,000
Maryland	96,900	32 25	3,125,025	126,900	4 12	522,828	256,600	5 11	1,311,226
Virginia	234,000	24 93	5,833,620	386,900	2 70	1,044,630	810,500	3 58	2,901,590
North Carolina	205,400	21 89	4,496,206	296,200	1 57	465,034	875,100	3 00	2,625,300
South Carolina	154,800	23 65	3,661,020	153,500	1 91	293,185	339,400	3 30	1,120,020
Georgia	260,000	20 81	5,410,600	258,700	1 53	395,811	1,528,900	3 32	5,075,948
Florida	74,200	14 03	1,041,026	29,200	1 73	50,516	185,400	2 59	480,186
Alabama	180,700	18 83	3,402,581	188,100	1 82	342,342	981,000	3 66	3,590,460
Mississippi	183,800	23 73	4,361,574	174,000	1 95	339,300	918,000	3 45	3,167,100
Louisiana	90,900	25 00	2,272,500	77,400	2 14	165,636	288,000	4 51	1,298,880
Texas	602,400	14 12	8,505,888	1,239,600	1 52	1,884,192	1,272,000	2 69	3,421,680
Arkansas	140,500	21 33	2,996,865	147,100	2 29	336,859	1,036,300	3 82	3,958,666
Tennessee	242,900	22 83	5,545,407	392,000	1 74	682,080	1,580,800	3 32	5,248,256
West Virginia	118,400	33 85	4,007,840	540,000	2 39	1,290,600	331,700	3 65	1,210,705
Kentucky	229,400	32 51	7,457,794	868,100	2 61	2,265,741	2,113,700	3 34	7,059,758
Ohio	771,000	37 36	28,804,560	4,548,100	3 11	14,144,591	2,173,600	5 21	11,324,456
Michigan	347,200	36 86	12,797,792	3,164,900	2 86	9,051,614	532,900	4 67	2,488,643
Indiana	444,200	33 57	14,911,794	1,953,000	2 54	4,960,620	2,489,900	4 93	12,275,207
Illinois	697,000	33 77	23,537,690	1,367,000	2 66	3,636,220	3,598,400	4 70	16,912,480
Wisconsin	405,500	29 29	11,877,095	1,098,200	2 66	2,921,212	651,900	4 41	2,874,879
Minnesota	168,900	29 70	5,016,330	145,600	2 62	381,472	203,500	5 19	1,056,165
Iowa	511,800	28 49	14,581,182	1,822,700	2 20	4,009,940	3,596,000	4 76	17,116,960
Missouri	393,400	25 85	10,169,390	1,451,900	1 97	2,860,243	2,530,000	3 25	8,222,500
Kansas	191,100	30 77	5,880,147	116,100	2 34	271,674	381,000	5 51	2,099,310
Nebraska	41,700	35 00	1,459,500	33,300	2 46	81,918	102,800	5 72	588,016
California	186,800	44 66	8,342,488	3,672,300	2 78	10,208,994	440,600	5 05	2,225,030
Oregon	66,700	37 90	2,527,930	486,200	2 45	1,191,190	158,400	3 79	600,336
Nevada	7,800	40 00	312,000	12,800	3 75	48,000	4,300	7 00	30,100
The Territories	201,200	34 12	6,864,944	1,725,000	3 10	5,347,500	89,300	7 12	635,816
Total	10,303,500	....	329,408,983	31,679,300	....	88,771,197	31,796,300	....	138,733,828
Grand average of prices	....	31 97	....	....	2 80	....	....	4 36	....

THE WOOL BUSINESS.

The increase of woolen manufactures since 1860 has been one of the most marked and beneficent features of the recent progress of American industry. New branches of textile fabrication, including the manufacture of various styles of carpets, fine worsted goods for ladies, new styles of fancy cassimeres, braids, &c., have been introduced, and the prices of some have been actually cheapened, notwithstanding the duties imposed upon competing goods, as the result of home competition. Greater progress has been made, in respect to quality and variety of goods, and the extent of their manufacture, since 1860 than for a period of twenty years anterior to that date. The number of sets of cards in operation in 1860, as returned by the census, was 3,209; in 1870 it was 8,386. The increase in the West is remarkable; that of Ohio, from 173 to 357; Indiana, from 112 to 346; Illinois, from 37 to 254; Wisconsin, from 19 to 131; Michigan, 14 to 116; and in similar proportion elsewhere. The quality of a portion of this western manufacture is superior, and the advantages of this industry to the western people are many and great. The following table shows the increase made during the decade, as compiled from census returns:

States and Territories	1870.*			1860.		
	Establishments.	Sets of cards.	Looms.	Producing woolen fabrics. Establishments.	Producing woolen fabrics. Sets of cards.	Establishm'ts carding wool, & dressing cloth only.
Alabama	14	24	2	6	14	10
Arkansas	13	17	...	...	...	11
California	6	52	170	1	6	...
Connecticut	109	660	2,893	84	265	...
Delaware	11	30	221	4	8	2
Florida	1	1	...	...	...	...
Georgia	44	68	395	11	30	19
Illinois	109	254	624	21	37	29
Indiana	175	346	1,180	79	112	41
Iowa	85	196	374	12	13	16
Kansas	9	24	29	...	...	...
Kentucky	32	51	322	37	83	81
Louisiana	2	12	100	1	4	1
Maine	107	321	1,161	26	80	37
Maryland	30	59	145	27	44	3
Massachusetts	183	1,367	7,746	134	821	5
Michigan	54	116	232	16	14	15
Minnesota	10	19	39	...	...	1
Mississippi	8	13	30	4	13	6
Missouri	156	258	183	11	15	86
New Hampshire	77	505	1,558	51	146	17
New Jersey	29	81	603	35	61	...
New York	248	834	2,460	140	324	55
North Carolina	48	70	97	7	23	21
Ohio	216	357	1,147	115	173	48
Oregon	5	16	90	1	4	1
Pennsylvania	471	1,360	8,692	270	482	39
Rhode Island	64	469	2,536	57	253	...
South Carolina	15	25	9	1	10	9
Tennessee	148	176	80	1	1	69
Texas	20	29	30	2	4	8
Vermont	65	175	670	46	99	5
Virginia	67	109	137	45	50	63
West Virginia	72	113	120	...	...	...
Wisconsin	64	131	270	15	19	11
New Mexico Territory	1	1	5	...	...	...
Utah Territory	15	19	31	...	...	3
Total	2,783	8,368	34,381	1,260	3,209	712

* Approximate.

The following report to the Commissioner, made by the Statistician, is in answer to a resolution of the United States Senate inquiring for statistics illustrating the fluctuations of the past ten years in the production and price of American wool, and embodies facts intended for this annual report:

The importations during the fiscal years from 1861 to 1871, inclusive, are officially reported as follows:

Years.	Woolens.	Wool.		
	Value.	Pounds.	Value.	Cents per pound.
1861	$28, 261, 089	36, 000, 000	$4, 961, 326	13. 7
1862	14, 884, 394	43, 571, 026	6, 994. 606	16
1863	20, 411, 625	73, 897, 807	12, 553, 931	16. 9
1864	32, 139, 336	90, 396, 104	15, 923. 991	17. 6
1865	20, 347, 563	43, 858, 154	7, 728. 383	17. 6
1866	57, 115, 901	67, 917, 031	9, 381, 083	13. 8
1867	45, 813, 212	36, 318. 299	5, 915, 178	16
1868	32, 371, 329	24, 124, 803	3, 792. 659	15. 7
1869	34, 560, 324	39, 275, 926	5. 600, 958	14. 2
1870	34, 435, 623	49, 230, 199	6, 743, 350	13. 6
1871	43, 751, 973	68, 058, 028	9, 780, 443	14. 3
Totals	364, 092, 319	572, 647, 377	89, 375, 908	

The imports of woolens since 1860 have been but little more in nominal value, probably less in quantity, than for the decade preceding; averaging $32,652,726, against $28,268,283 for the period between 1850 and 1860. The unusual exigencies of the period since 1860 creating unprecedented demand for woolen goods, and causing much waste and loss, have been met, through the increase of home manufactures, with a smaller importation *per capita* than in the preceding period of low prices and universal peace.

While the imports of wool have necessarily been larger, the average annual receipts being fifty-two millions of pounds, instead of twenty-three millions, as for ten years prior to 1860, the home production has increased in almost exactly the same ratio, or from fifty-six millions of pounds to one hundred and fifteen millions. About two-thirds of the quantity of wool manufactured is produced in this country.

The quantity of shoddy imported in ten years ending in 1871, not included in the statement above, amounts to forty-two millions seven hundred and one thousand five hundred and twenty-one pounds, valued at $3,423,916, or about 8 cents per pound.

The average price of foreign wools, as seen in the table, (the price in gold at the port of shipment,) advanced, very uniformly, from 13.7 cents in 1861 to 17.6 cents in 1865; then receded, at the close of the period of civil war in this country, to 13.8, but advanced again to 16 cents, under the influence of the extraordinary importation of 1866, from which date the decline has been gradual and regular to 1871, when the reserve supplies of raw material became exhausted by a constantly enlarging consumption of manufactured goods, and the rate was again advanced.

The home production of wool has passed through extraordinary vicissitudes since 1861. Under the stimulus of the war demand, and the protection afforded by the premium on gold, the number of sheep was nearly doubled in six years. No complete official estimate of numbers was published during this period. A careful review of all existing data enables me to present a close approximate estimate of the aggregate numbers of sheep, and the quantities of wool thrown upon the market in each year since 1861:

Years.	Number of sheep.	Pounds of wool.
1861	21, 500, 000	55, 000, 000
1862	24, 000, 000	67, 500, 000
1863	28, 000, 000	82, 500, 000
1864	31, 000, 000	95, 000, 000
1865	35, 000, 000	115, 000, 000
1866	38, 000, 000	135, 000, 000
1867	42, 000, 000	147, 000, 000
1868	41, 500, 000	155, 000, 000
1869	37, 000, 000	143, 000, 000
1870	34, 000, 000	135, 000, 000
1871	32, 000, 000	128, 000, 000

The increase in wool was relatively larger than the increase in sheep, from 1861 to 1867, from the constantly widening use of heavy wooled merino rams for breeding purposes, until much of the coarse wool of Texas, of California, of Colorado, and even of New Mexico was more or less modified by the merino blood, in all cases tending to an increase of the weight of the fleece. Since 1867 there has been little care exercised in breeding, but the flocks have been kept well culled, and should average as heavy fleeces as at that date. The average weight of fleece in 1870, so far as it is indicated by a comparison of the census exhibit of sheep and wool, is 3.51 pounds; in 1860, 2.73 pounds; in 1850, 2.42 pounds.

The estimates of wool for the years since 1867 are, apparently, larger in proportion to the numbers of sheep. The excess is only in appearance, the numbers of sheep being estimated in February in each year, while the quantity of wool is the amount produced through the year. Thus, the estimate for 1868 is eight millions of pounds above that for 1867, while the number of sheep is slightly reduced, the excess arising from the fleeces and pulled wool of four millions of sheep slaughtered in the latter portion of 1868. The same cause, though operating less forcibly, produced an excess of wool in proportion to numbers of sheep in the succeeding years. These estimates are somewhat below those of wool brokers, while they are higher than estimates based exclusively on census returns, which are manifestly very incomplete, especially in Texas, California, and the Territories. Moreover, the census returns include only the sheep on farms, leaving considerable numbers in towns, or *in transitu* to markets or distant pasturage.

Facts illustrating "the causes of fluctuation in numbers of sheep and prices of wool" are abundant and of transparent meaning. They are those of demand and supply, of abundant production of wool, decline in sales of woolen goods, increase of cotton-growing, reduction in value of wool, and the short-sightedness of those farmers who habitually over-produce when prices are high, and sacrifice any valuable branch of husbandry at the moment it temporarily fails to yield a satisfactory profit.

At the close of the war, which had crippled the cotton supply of the world and stimulated the manufacture of other textiles as substitutes, the wool product had greatly increased in Australia, South Africa, South America, in North America, and even in Europe.*

Prices abroad were falling, in the expectation that cotton would promptly occupy its former position; prices in this country were still further reduced by the decline of the gold premium. Our wool-growers, who had become elated with the unaccustomed prosperity of the recent past, at once succumbed to despondency, sold their flocks, some for migration across the Missouri, others for the city markets, and larger numbers for indiscriminate slaughter for pelts and tallow. This destruction commenced in the autumn of 1868, and resulted in the diminution of the aggregate number by at least four millions during the winter. They were killed for pelts and tallow even in New England; in New York, where the best were sold for mutton, the culls brought from 75 cents to $1.50 each; in the principal wool-growing sections of Ohio the numbers slaughtered ranged from 10,000 to 40,000 in each county; in Michigan and other Western States the slaughter was in almost equal proportion. The assessors' returns for the State of Ohio show a reduction in 1868 of 1,349,855, and a further diminution in two subsequent years of 1,969,736, due partly to slaughtering, and partly to migration westward. The total decrease in three years, from 7,622,495 to 4,302,904, amounted to 43 per cent.

Something of this loss is due rather to disease than to the knife. Flocks were

* The following table gives the quantity of wool imported into Great Britain during ten years, with the declared value, which is reduced to our currency in the statement of the price per pound. These prices, which are higher than those of our imports of wool (mainly carpet wools) show a similar advance and decline in the years of inflation or depression.

Total wool imports, with computed value, including sheep, lamb, alpaca, and llama imported into the United Kingdom.

Years.	Quantity.	Value.	Price per pound.
	Pounds.		*Cents.*
1861	147, 172, 841	£9, 717, 686	33
1862	171, 943, 472	11, 773, 943	34. 2
1863	177, 377, 664	11, 884, 572	33. 5
1864	206, 473, 045	15, 503, 483	37. 5
1865	212, 206, 747	14, 930, 430	35. 1
1866	239, 358, 689	17, 550, 871	36. 6
1867	233, 703, 184	16, 178, 034	34. 6
1868	252, 744, 155	15, 120, 498	29. 9
1869	258, 461, 689	14, 696, 746	28. 4
1870	263, 250, 499	15, 812, 598	30

neglected, foot-rot, scab, and numerous forms of disease prevailed, and the inroads of disease were encouraged by starvation and want of shelter. Local returns were full of accounts of these losses. In Steuben County, New York, "the loss was 15 per cent. from neglect and low feeding." In Erie County, Pennsylvania, "flocks were reduced one-third by foot-rot." In Hampden, Massachusetts, "three-tenths of the lambs died from want of natural food, many of the mothers having little milk." A farmer in Benton County, Missouri, neglecting all attention to his flock of 400, "lost 300 by scab." Similar returns were received from all portions of the country. The following statement upon this point is from the annual statistical review of the condition of farm stock from the April (1869) report of this division:

"The reports relative to sheep are not so favorable. The wool business has been comparatively unprofitable of late, and the inevitable result is neglect, short commons, a supply of mouldy hay, and the roughest treatment in too many instances, resulting in leanness, weakness, and the insidious approaches of disease. Where they have been suitably cared for they are healthy, and as merinoes are in present disfavor, disease is mainly among flocks of that breed. Were it not for the culling process, by which several millions of the poorest (60,000 in some cases in a single county) have been remorselessly slaughtered for their pelts and the small modicum of fat that could be drained by hydraulic pressure from their juiceless carcasses, the ravages of disease would have proved far greater. This weeding out of the victims of poverty will result beneficially in elevating the average health and condition. Wool-growers, whose fears have overcome their judgment, and caused the depreciation of their flocks, or the abandonment of their business, will, ere long, regret their hasty action."

There was some cause for this depression, prices having declined below a paying standard, though some of the most skillful and experienced flock-masters were still able to realize moderate profits. In anticipation of an increase in the customs duties on wools and woolens, a quantity of manufactured goods had been imported in a single year (the fiscal year 1866) equal to about one-half of the entire importations of five years previous—$57,115,901, against an average annual importation of $23,208,791. The importation of wool was 67,917,031 pounds, an increase of 24,058,877 over that of 1865, and almost equal to the average of the four years of the war, when a double supply was required. In addition to this, an enormous supply of military clothing* was thrown upon the market at nominal prices. The overcoats alone disposed of since 1865 by the War Department number 2,218,917, nearly sufficient to furnish an overcoat to one-third of all the voters in the United States.

Here was a *surplus* of manufactures costing $30,000,000 in gold at the port of shipment, of several millions of garments from military stores, of at least 35000000

* The following note from General M. C. Meigs incloses a statement of the amount of woolen military goods disposed of since June 30, 1865:

War Department, Quartermaster General's Office,
Washington, D. C., April 12, 1872.

Sir: In compliance with your request of the 4th instant, I have the honor to inclose herewith a statement of the quantity of woolen articles of clothing and equipage, and clothing materials, sold and otherwise disposed of from the stock on hand June 30, 1865, (or since obtained,) during the fiscal years ending June 30, 1866, to 1871, inclusive.

This statement does not include the issues made during the above period to the Army of the United States.

Very respectfully, your obedient servant,

M. C. MEIGS,
Quartermaster General, Brevet Major General, U. S. A.

J. R. Dodge, Esq.,
Statistician of Agricultural Department, Washington, D. C.

Article.	Quantity.	Article.	Quantity.
Blankets, woolen	802, 419	Talmas	95
Trousers, foot	261, 943	Stockings, pairs	216, 380
Trousers, mounted	90, 717	Mittens, pairs	50, 041
Trousers, zouave	1, 227	Turbans, zouave	1, 635
Great coats, mounted	174, 901	Vests, zouave	2, 789
Great coats, foot	2, 001, 258	Scarfs, zouave	71
Great coats, irregular	42, 758	Sashes	330
Uniform coats, all kinds	267, 500	Flags, storm and garrison	973
Sacque coats, all kinds	559, 253	Bugle and trumpet cords and tassels	1, 184
Uniform jackets, all kinds	377, 082	Flannel, woolen, yards	114, 903
Uniform jackets, knit	50, 647	Lace, yards	697, 990
Shirts, wool, flannel	205, 181	Dark blue cloth, yards, 6-4	19, 172
Shirts, wool, knit	198, 825	Dark blue cloth, yards, 3-4	41, 619
Forage caps	402, 065	Kersey, yards, 6-4	267
Zouave caps	8, 582	Kersey, yards, 3-4	152, 951
Uniform hats, felt	177, 328	Facing cloth, yards	425
Uniform hats, cords, and tassels	51, 594	Alpaca, yards	799
Drawers, knit	26, 767	Cuttings, woolen, pounds	94, 752
Chevrons, pairs, assorted	58, 474		

pounds of wool imported, of 7,147,108 pounds of shoddy imported, and millions more made from worn-out military and other clothing; and, in addition, a market previously burdened with stocks so heavy as to cause considerable depression of prices. But one result was possible—a further decline of prices until the glut in the market should be removed.

This surplus was piled up before the tariff of 1867 was enacted. The horse was stolen before the stable was locked. Yet no tariff could have prevented altogether a decline in prices, which had already commenced throughout the world, and had been progressing in this country since the retrograde of the gold premium from its highest point in 1864. But the law of 1867 cut off about two-thirds of this abnormal importation of wools. The Argentine Republic, the great competitor of our wool-growers, which had contributed 36,916,794 pounds in 1866, sent but 26,752,197 pounds in all the three following years. The wisest wool-growers held on, sustained with a belief that prices would advance, and knowing that without the tariff wide-spread and general ruin must have resulted to their business. The length of the period of depression was calculated, and a prediction of appreciation in prices of wools and revival of wool growing was duly fulfilled, in accordance with the reported facts of production, manufacture, and consumption of the wools of the civilized world.

A statement giving the estimated average prices of sheep on the 1st of February of the years named, as calculated from annual statistical returns of prices of farm animals.

States.	1866.	1867.	1868.	1869.	1870.	1871.	1872.
Maine	$4 67	$3 37	$2 76	$3 07	$2 76	$2 73	$3 08
New Hampshire	4 84	3 44	2 55	2 45	2 59	2 35	2 93
Vermont	5 92	3 79	2 79	2 67	2 89	2 62	4 26
Massachusetts	5 30	4 20	3 44	3 37	3 28	3 26	3 51
Rhode Island	6 00	3 65	3 59	3 93	4 32	3 71	3 62
Connecticut	5 97	5 39	4 02	4 72	4 42	4 07	4 28
New York	5 00	4 55	3 23	3 05	3 04	3 14	4 02
New Jersey	6 55	6 31	4 03	4 61	4 41	4 81	5 08
Pennsylvania	4 90	4 08	3 04	2 62	2 86	3 16	3 41
Delaware	4 25	4 62	3 37	3 50	4 37	3 75	4 00
Maryland	5 83	4 58	3 92	4 16	4 09	3 86	4 12
Virginia	....	2 56	2 48	2 40	2 58	2 37	2 70
North Carolina	....	1 77	1 66	1 71	1 66	1 63	1 57
South Carolina	....	2 08	1 87	1 77	1 73	1 95	1 91
Georgia	....	1 87	1 71	1 62	1 68	1 65	1 53
Florida	....	2 34	2 07	2 80	2 00	1 31	1 73
Alabama	....	1 98	1 76	1 37	1 59	1 77	1 82
Mississippi	....	1 97	1 52	1 90	1 77	2 00	1 95
Louisiana	....	2 92	1 27	1 54	2 00	2 18	2 14
Texas	....	2 15	1 86	1 38	1 70	1 40	1 52
Arkansas	....	2 68	2 69	2 71	2 00	2 32	2 29
Tennessee	....	4 77	1 85	2 04	1 82	1 66	1 74
West Virginia	....	....	2 30	1 67	1 89	2 11	2 39
Kentucky	3 97	2 95	2 48	2 56	2 75	2 53	2 61
Ohio	4 58	3 10	2 44	1 70	1 98	2 26	3 11
Michigan	4 26	3 40	2 47	1 87	1 93	2 23	2 86
Indiana	3 30	2 43	1 88	1 63	1 73	1 82	2 54
Illinois	3 77	3 13	2 20	1 86	1 65	1 98	2 66
Wisconsin	4 71	3 52	2 62	2 38	2 13	2 44	2 66
Minnesota	4 22	3 62	2 67	2 32	2 42	2 22	2 62
Iowa	3 78	3 00	2 11	1 80	1 57	1 71	2 20
Missouri	2 87	2 33	2 14	1 79	1 70	1 61	1 97
Kansas	3 80	3 28	2 11	2 62	2 11	2 53	2 34
Nebraska	3 67	3 61	3 15	2 71	2 50	2 24	2 46
California	....	....	....	2 53	2 56	2 59	2 78
Oregon	....	....	....	....	1 90	1 90	2 45
Nevada	....	....	....	....	....	4 31	3 75

A statement presenting the principal sources of foreign-wool supply, and the amount received from each country during ten years.

Years.	Great Britain.	South Africa.	Australia.	Argentine Republic.	Uruguay.
1862	16, 006, 963	3, 920, 257	783, 670	5, 786, 868	14, 061
1863	17, 619, 123	6, 711, 975	118, 234	17, 461, 208	476, 815
1864	13, 099, 501	13, 717, 900	864, 548	23, 951, 506	3, 490, 800
1865	1, 980, 176	8, 312, 768	408, 592	16, 103, 889	1, 164, 260
1866	8, 541, 195	7, 424, 217	874, 119	36, 916, 794	2, 224, 629
1867	6, 758, 820	2, 033, 020	467, 025	12, 606, 274	1, 434, 594
1868	2, 581, 678	964, 314	....	5, 835, 864	466, 712
1869	8, 598, 299	2, 644, 504	....	8, 249, 659	932, 369
1870	8, 140, 697	5, 089, 153	168, 902	16, 721, 420	1, 547, 106
1871	15, 593, 166	6, 699, 057	19, 957	23, 333, 237	4, 594, 238

South America has furnished our main supplies of clothing-wool. An enormous importation (36,916,794 pounds from the Argentine Republic alone) was received pending the action of Congress on the tariff in 1866. Comparatively little wool, competing with our merino, was from that date brought in until 1870, when the exhaustion of manufacturers' stocks of this grade again made necessary a moderate importation.

RICE PRODUCTION.

Material misapprehension of the facts of rice production exists in the public mind. It is stated that rice culture is not extending; that it felt the effects of war's devastation less than cotton, and should, therefore, recuperate more rapidly; neither of which propositions is true. The rice-planters were driven from the Carolina and Georgia shores during war, labor was in a disorganized and chaotic state, production had almost ceased, and at its close, dams and flood-gates, quarter-drains and canals, mills, barns, and houses were either dilapidated or destroyed, and the power to compel the laborers to go into the rice swamps was utterly broken. The laborers had scattered, gone into other business, and those obtainable would only work for themselves upon a share contract. Many of the proprietors were dead, and more absentees; and inexperienced men from the North or elsewhere assumed their places. The rice-fields had grown up in weeds and tangled shrubbery, the labor of reparation was discouraging, and the work of cultivation was greatly increased, giving unexpected gravity to the contingencies and accidents of the season.

These difficulties have been gradually disappearing on the Atlantic coast, yet the labor question is still one of great importance. Production is increasing regularly but slowly. The negroes are becoming accustomed to *quasi* proprietorship, and with the aid of capital in repairing works and replacing structures and machinery, and with protection against foreign competition, they will utilize otherwise worthless wastes, and add millions annually to the wealth of the country.

In 1869 the crop of South Carolina, as returned by the census authorities, was 32,304,825 pounds; of Georgia, 22,277,380; of North Carolina, 2,059,281. Production had nearly ceased in 1865. The commercial returns of Carolina rice show an increase as follows: 1866, 21,031 tierces; 1867, 23,482; 1868, 37,047; 1869, 41,172. An increase was also reported in 1870, but the season of 1871 was unpropitious, and the record may show a decrease.

Dr. J. J. Waring, of Savannah, gives local figures illustrating the rate of increase as follows: 1866, 12,500 casks; 1867, 24,337; 1868, 30,795; 1869, 60,146; 1870, 67,736.

In Georgia, two-thirds of the rice is grown in Chatham and Camden Counties, half in the vicinity of Savannah. In South Carolina nearly half the crop is grown in Georgetown. The following figures show how small a district yielded the rice of the palmy days of 1859:

South Carolina.	Pounds.	Georgia.	Pounds.
Georgetown	55, 805, 385	Chatham	25, 934, 160
Colleton	22, 838, 984	Camden	10, 330, 068
Charleston	18, 899, 512	McIntosh	6, 421, 100
Beaufort	18, 790, 918	Glynn	4, 842, 755
Total	116, 334, 799	Total	47, 528, 083
Twenty-four other counties	2, 765, 729	Eighty-eight other counties	4, 979, 569
Total	119, 100, 528	Total	52, 507, 652

But the extension of rice culture in Louisiana is a triumphant refutation of the assertion that the business cannot prosper under the most favorable present circumstances. The census exhibits it as follows: 1849, 4,425,349 pounds; 1859, 6,331,257 pounds; 1869, 15,854,012 pounds. The record of M. Bouchereau, by plantations, accounts for a total crop, in 1869, of 100,748 barrels, of 200 pounds each, or 20,149,600 pounds. The crop of 1870 was not a successful one. In 1859, Plaquemines Parish yielded 4,635,500 pounds of the crop of 6,331,257 pounds, or about two-thirds of the total product of the State. In 1869 the same parish produced 6,247,400 pounds, (record of Bouchereau,) and yet it was less than a third of the crop of the State, and returns were made from 14 other parishes.

The following is a census exhibit of rice production at three decennial periods:

States.	1870.	1860.	1850.
	Pounds.	*Pounds.*	*Pounds.*
Alabama	222, 945	493, 465	2, 312, 252
Arkansas	73, 021	16, 831	63, 179
California	....	2, 140	....
Florida	401, 687	223, 704	1, 075, 090
Georgia	22, 277, 380	52, 507, 652	38, 950, 691
Kentucky	....	....	5, 688
Louisiana	15, 854, 012	6, 331, 257	4, 425, 349
Mississippi	374, 627	809, 082	2, 719, 856
Missouri	....	9, 767	700
North Carolina	2, 059, 281	7, 593, 976	5, 465, 868
South Carolina	32, 304, 825	119, 100, 528	159, 930, 613
Tennessee	3, 399	40, 872	258, 854
Texas	63, 844	26, 031	88, 203
Virginia	....	8, 225	17, 154
Michigan	....	716	....
Minnesota	....	3, 286	....
Total	73, 635, 001	187, 167, 032	215, 313, 497

The following statement of exports and imports of rice has been furnished by Edward Young, Chief of Statistics in the Treasury Department:

Years.	Domestic exports.			
	Tierces.*	Barrels.†	Pounds.	Value.
1850	127, 069	....	76, 241, 400	$2, 631, 557
1851	105, 590	....	63, 354, 000	2, 170, 927
1852	119, 733	....	71, 839, 800	2, 471, 029
1853	67, 707	....	40, 624, 200	1, 667, 658
1854	105, 121	....	63, 072, 600	2, 634, 127
1855	52, 520	19, 774	39, 421, 600	1, 717, 953
1856	58, 668	81, 038	67, 616, 000	2, 390, 233
1857	64, 332	74, 309	68, 322, 800	2, 290, 400
1858	64, 015	49, 283	58, 122, 200	1, 870, 578
1859	81, 820	69, 946	75, 070, 400	2, 207, 148
1860	84, 163	77, 837	81, 632, 600	2, 567, 399
1861	39, 162	50, 038	43, 512, 400	1, 382. 178
1862	2, 146	7, 335	4, 221, 600	156, 899
1863	494	3, 496	1, 694, 800	83, 404
1864	....	5, 442	2, 176, 800	84. 217
1865	....	2, 458	983, 200	65, 105
1866	....	....	2, 212, 901	136, 993
1867	....	....	1, 394, 007	100, 338
1868	....	....	3, 079, 043	170, 357
1869	....	....	2, 232, 833	145, 934
1870	....	....	2, 133, 014	127, 655

Years.	Foreign exports.		Imports.	
	Pounds.	Value.	Pounds.	Value.
1861	348,900	$10,856	148,550	$3,610
1862	2,339,146	103,738	56,961,317	1,589,109
1863	7,844,068	392,134	61,196,740	1,760,077
1864	7,637,635	452,722	99,691,447	1,911,330
1865	8,290,318	559,465	60,407,756	1,474,393
1866	8,636,060	337,016	76,209,397	2,379,857
1867	4,676,082	180,043	44,782,223	1,219,387
1868	11,908,953	403,941	59,140,707	1,636,492
1869	8,868,664	284,632	54,065,191	1,325,234
1870	15,212,833	454,316	43,123,939	1,007,612

* Estimated at 600 pounds each. † Estimated at 400 pounds each.

In conclusion, these are the facts: The culture of rice is rapidly extending in Louisiana, and may be extended to nearly every parish in the State. It is slowly but surely overcoming its serious hinderances on the marshes of the Atlantic coast. It is mainly carried on by negroes on their own account, as a business in which they had a life-time training, and its destruction would therefore be a serious calamity to a needy but industrious class of our population, and there is no reason why the home supply of rice should not soon be met without importation. It must be deemed an absurdity, if not a disgrace, for a country like ours to assume the necessity of importing cereals or breadstuffs in any form.

CENSUS OF 1870.

The work of tabulation and publication of the census returns, under the direction of the Superintendent, General F. A. Walker, has been pushed with unusual energy, and its publication, in several volumes, will follow with unaccustomed promptness. Advance sheets of the agricultural tables have been received at this office, and certain analyses, deductions, and re-combinations are presented in the following pages to facilitate comparison and a better understanding of the lessons taught by these facts, of agricultural production and resources.

It is no fault of General Walker and his assistants that the enumeration was left in charge of officers with duties entirely foreign to this work, to be accomplished by crude methods devised for the first general enumeration undertaken by the Government, and to exclude some of the most essentially important schedules, such as area in the different crops, which is the first point secured in European enumerations, and in some cases has been the only one. The enumeration was taken under the law of 1850, as slightly amended, after the failure of a general bill for taking the census of 1870.

The Superintendent, in accordance with my earnest solicitation, divided the "unimproved" land, making separate schedules for "wood land" and "other unimproved," by which, for the first time, can be shown approximately the extent of area in forest.

Farm Area.—The area of land in farms was 293,560,614 acres in 1850, of which 113,032,614 were improved, and 180,528,000 unimproved. In 1860 the total area was 407,212,538 acres, 163,110,720 improved, and 244,101,818 unimproved. The late census made the total area 407,735,041 acres, 188,921,099 improved, and 218,813,945 unimproved. The proportion of improved land has been constantly increasing, first from 38 per cent. to 40, and now to 46, showing that the most desirable lands have been taken up, and that the tendency to improve the original acres

is becoming comparatively stronger, and that for getting more land is weakening. As farm lands increase in price this tendency will become more marked, and ultimately, when western lands can no longer be obtained at nominal prices, and the era of high culture dawns, there will be an appreciation in the price of eastern lands, especially those of New England, some of which are now the cheapest improved lands in the United States. The increase in unimproved lands between 1850 and 1860 was 63,573,818 acres; in the last ten years, according to the record, the increase in all farm lands was but 522,503 acres, and the decrease in unimproved lands was 25,287,873 acres. As there has been a considerable addition to the area in farms by homstead entry and by purchase, the fact that there is no material enlargement of the aggregate can only be accounted for, if the returns are complete and accurate, by the lapsing of title during the changes of the last ten years; *e.g.*, Florida had, in farms, 2,920,228 acres in 1860, and but 2,373,541 in 1870, and the area "improved" was larger in 1870.

The total area in woodland is 159,310,177 acres, or 39 per cent. of the aggregate of 407,735,041 acres in farms. The Southern States are remarkably well wooded, the twelve States from Maryland to Tennessee averaging 52 per cent.; the New England States have 32 per cent. of their farm area in forest; the Middle States 28 per cent.; and the Central States, from West Virginia to Nebraska, averaging 32 per cent. West Virginia has 51 per cent.; Kentucky, 48; Ohio, 31; Indiana, 39; Illinois, 19; Iowa, 16; Kansas, 11; Nebraska, 10; California, 4. The Territories are not rich in forests, except Washington, which has 44 per cent. of its farm area in woodland.

Among the Territories, Wyoming has the smallest proportion of private lands improved—only $7\frac{7}{10}$ per cent. of 4,341 acres held in personal ownership, amounting to 338 acres, or enough for a single farm of generous size. The entire area of Wyoming includes 62,645,068 acres. Colorado has but 320,346 acres in farms, nearly 30 per cent. of which is improved, and her total area is 66,880,000 acres. New Mexico, with 77,568,640 acres, has 833,549 acres in farms, 143,007 improved. These citations will show the almost microscopic proportion of lands owned by private parties. These returns, however, do not cover all lands in these Territories disposed of by the United States, according to the following statement from the Land Office:

Territories.	Total acres.	Acres unappropriated.
Washington	44,796,160.00	40,976,976.60
New Mexico	77,568,640.00	70,677,735.84
Utah	54,065,043.20	48,659,916.27
Dakota	96,596,128.00	90,567,020.47
Colorado	66,880,000.00	62,382,773.26
Montana	92,016,640.00	86,768,100.09
Arizona	72,906,240.00	68,855,730.00
Idaho	55,228,160.00	52,103,783.04
Wyoming	62,645,068.00	59,163,834.49
Indian	44,154,240.00	44,154,240.00

Statement of the number of acres of improved and unimproved lands in farms in the States and Territories, and of the value of farms and farm-implements.

STATES.	Acres of land.							Value of farms.		Value of farm implements.	
	Number of acres in farms.	Improved.		Unimproved.							
		Acres.	Percentage of total acreage.	Wood-land acres.	Percentage of total acreage.	Other unimproved acres.	Percentage of total acreage.	Total value.	Value per acre.	Total value.	Proportion to each acre.
Maine	5, 838, 058	2, 917, 793	49. 9	2, 224, 740	38. 1	695, 525	11. 9	$102, 961, 951	$18 93	$4, 809, 113	$0 88
New Hampshire	3, 605, 994	2, 334, 487	64. 7	1, 047, 090	29	224, 417	6. 2	80, 589, 313	22 34	3, 459, 943	95
Vermont	4, 528, 804	3, 073, 257	67. 8	1, 386, 934	30. 6	68, 613	1. 5	139, 367, 075	30 77	5, 250, 279	1 15
Massachusetts	2, 730, 283	1, 736, 221	63. 5	706, 714	25. 8	287, 348	10. 5	116, 432, 784	42 64	5, 000, 879	1 83
Rhode Island	502, 308	289, 030	57. 5	169, 399	33. 7	43, 879	8. 7	21, 574, 968	42 95	786, 246	1 56
Connecticut	2, 364, 416	1, 646, 752	69. 6	577, 333	24. 4	140, 331	5. 9	124, 241, 382	52 54	3, 246, 599	1 37
New York	22, 190, 810	15, 627, 206	70. 4	5, 679, 870	25. 5	883, 734	3. 9	1, 272, 857, 766	57 35	45, 997, 712	2 07
New Jersey	2, 989, 511	1, 976, 474	66. 1	718, 335	24	294. 702	9. 8	257, 523. 376	86 14	7, 887, 991	2 63
Pennsylvania	17, 994, 200	11, 515, 965	63. 9	5, 740, 864	31. 9	737, 371	4	1, 043, 481, 582	57 98	35, 658, 196	1 98
Delaware	1, 052, 322	698, 115	66. 3	295, 162	28	59, 045	5. 6	46, 712, 870	44 39	1, 201, 644	1 14
Maryland	4, 512, 579	2, 914, 007	64. 5	1, 435, 988	31. 8	162, 584	3. 6	170, 369, 684	37 75	5, 268, 676	1 16
Virginia	18, 145, 911	8, 165, 040	44. 9	8, 294, 734	45. 7	1, 686, 137	9. 2	211, 626, 575	11 77	4, 902, 884	27
North Carolina	19, 835, 410	5, 258, 742	26. 5	12, 026, 894	60. 6	2, 549, 774	12. 8	78, 211, 083	3 94	4, 082, 110	20
South Carolina	12, 105, 280	3, 010, 539	24. 8	6, 443, 851	53. 2	2, 650, 890	21. 8	44, 808, 763	3 70	2, 282, 946	18
Georgia	23, 647, 941	6, 831, 856	28. 8	12, 928, 084	54. 6	3, 838, 001	16. 4	94, 559, 468	3 99	4, 614, 701	19
Florida	2, 373, 541	736, 172	31	1, 425, 786	60	211, 583	8. 9	9, 947, 920	4 19	505, 074	21
Alabama	14, 961, 178	5, 062, 204	33. 8	8, 380, 332	56	1, 518, 642	10. 1	67, 502, 433	4 66	3, 256, 101	22
Mississippi	13, 121, 113	4, 209, 146	32	7, 959, 384	60. 6	952, 583	7. 2	81, 716. 576	6 22	4, 456. 633	33
Louisiana	7, 025, 817	2, 045, 640	29. 1	4, 003, 170	56. 9	977, 007	13. 9	67, 818, 827	9 75	7, 136, 998	1 02
Texas	18, 396, 523	2, 964, 836	16. 1	7, 662, 294	41. 6	7, 769, 393	42. 2	60, 149, 950	3 26	3, 396, 793	18
Arkansas	7, 597, 296	1, 859, 821	24. 3	3, 910, 325	51. 4	1, 827, 150	24	39, 625, 163	5 28	2, 223, 010	29
Tennessee	19, 581, 214	6, 843, 278	34. 9	10, 771, 396	55	1, 966, 540	10	218, 743, 747	11 17	8, 199, 487	41
West Virginia	8, 528, 394	2, 580, 254	30. 2	4, 364, 405	51. 1	1, 583, 735	18. 5	101, 604, 381	11 91	2, 112, 937	24
Kentucky	18, 660, 106	8, 103, 850	43. 4	9, 134, 658	48. 9	1, 421, 598	7. 6	311, 238, 916	16 67	8, 572, 896	45
Missouri	21, 707, 220	9, 130, 615	42	8, 965, 229	41. 3	3, 611, 376	16. 6	392, 917, 047	18 10	15, 596, 426	71
Illinois	25, 882, 861	19, 329, 952	74. 6	5, 061, 578	19. 6	1, 491, 331	5. 7	920, 506, 346	35 56	34, 576, 587	1 33
Indiana	18, 119, 648	10, 104, 279	55. 7	7, 189, 334	39. 6	826, 035	4. 5	634, 804, 189	35 03	17, 676, 591	97
Ohio	21, 712, 420	14, 469, 133	66. 6	6, 883, 575	31. 7	359, 712	1. 6	1, 054, 465, 226	48 56	25, 692, 787	1 18
Michigan	10, 019, 142	5, 096, 939	50. 8	4, 080, 146	40. 7	842, 057	8. 4	398, 240, 578	39 74	13, 711, 979	1 36
Wisconsin	11, 715, 321	5, 899, 343	50. 3	3, 437, 442	29. 3	2, 378, 536	20. 3	300, 414, 064	25 64	14, 239, 364	1 21
Minnesota	6, 483, 828	2, 322, 102	35. 9	1, 336, 299	20. 6	2, 825, 427	43. 5	97, 621, 691	15 17	6, 705, 586	1 04
Iowa	15, 541, 793	9, 396, 467	60. 4	2, 524, 793	16. 2	3, 620, 533	23. 2	392, 662, 441	25 26	20, 509, 582	1 31
Kansas	5, 656, 879	1, 971, 003	34. 8	635, 419	11. 2	3, 050, 457	53. 9	90, 327, 040	15 96	4, 053, 312	71

Statement of the number of acres of improved and unimproved lands in farms in the States and Territories, &c.—Continued.

STATES.	Acres of land.							Value of farms.		Value of farm implements.	
	Number of acres in farms.	Improved.		Unimproved.							
		Acres.	Percentage of total acreage.	Wood-land acres.	Percentage of total acreage.	Other unimproved acres.	Percentage of total acreage.	Total value.	Value per acre.	Total value.	Proportion to each acre.
Nebraska	2, 073, 781	647, 031	31. 2	213, 374	10. 2	1, 213, 376	58. 5	$30, 242, 186	$14 58	$1, 549, 716	$74
California	11, 427, 105	6, 218, 133	54. 4	477, 880	4. 1	4, 731, 092	41. 4	141, 240, 028	12 36	5, 316, 690	46
Oregon	2, 389, 252	1, 116, 290	46. 7	761, 001	31. 8	511, 961	21. 4	22, 352, 989	9 35	1, 293, 717	54
Nevada	208, 510	92, 644	44. 4	13, 415	6. 4	102, 451	49. 1	1, 485, 505	7 12	163, 718	78
TERRITORIES.											
Colorado	320, 346	95, 594	29. 8	11, 504	3. 5	213, 248	66. 5	3, 385, 748	10 56	272, 604	85
Utah	148, 361	118, 755	80	215	0. 1	29, 391	19. 8	2, 297, 922	15 48	291, 390	1 96
New Mexico	833, 549	143, 007	17. 1	106, 283	12. 7	584, 259	70	2, 260, 139	2 71	121, 114	14
Washington	649, 139	192, 016	29. 5	291, 206	44. 8	165, 917	25. 5	3, 978, 341	6 12	280, 551	43
Dakota	302, 376	42, 645	14. 1	22, 605	7. 4	237, 126	78. 4	2, 085, 265	6 89	142, 612	47
Montana	139, 537	84, 674	60. 6	1, 198	0. 8	53, 665	38. 4	729, 193	5 22	145, 438	1 04
Idaho	77, 139	26, 603	34. 4	7, 476	9. 6	43, 060	55. 8	492, 860	6 38	59, 295	76
Arizona	21, 807	14, 585	66. 8	....	....	7, 222	33. 1	161, 340	7 39	20, 105	92
Wyoming	4, 341	338	7. 7	35	0. 8	3, 968	91. 4	18, 187	4 18	5, 723	1 31
Indian	....	....	....	....	....	....	....	....	....	....	....

Statement showing the value of farm implements and machinery, with the proportion to each acre of improved land, in 1850, 1860, and 1870.

States.	1870.			1860.			1850.		
	Acres of improved land.	Value of farming implements and machinery.	Proportion to each acre.	Acres of improved land.	Value of farming implements and machinery.	Proportion to each acre.	Acres of improved land.	Value of farming implements and machinery.	Proportion to each acre.
Maine	2, 917, 793	$4, 809, 113	$1 64	2, 704, 133	$3, 298, 327	$1 21	2, 039, 596	$2, 284, 557	$1 12
New Hampshire	2, 334, 487	3, 459, 943	1 48	2, 367, 034	2, 683, 012	1 13	2, 251, 488	2, 314, 125	1 02
Vermont	3, 073, 257	5, 250, 279	1 70	2, 823, 157	3, 665, 955	1 29	2, 601, 409	2, 739, 282	1 05
Massachusetts	1, 736, 221	5, 000, 879	2 87	2, 155, 512	3, 894, 998	1 80	2, 133, 436	3, 209, 584	1 50
Rhode Island	289, 030	786, 246	2 72	335, 128	586, 791	1 75	356, 487	497, 201	1 39
Connecticut	1, 646, 752	3, 246, 599	1 96	1, 830, 807	2, 339, 481	1 27	1, 768, 178	1, 892, 541	1 07
New York	15, 627, 206	45, 997, 712	2 90	14, 358, 403	29, 166, 695	2 03	12, 408, 964	22, 084, 926	1 77
New Jersey	1, 976, 474	7, 887, 991	3 99	1, 944, 441	5, 746, 567	2 95	1, 767, 991	4, 425, 503	2 50
Pennsylvania	11, 515, 965	35, 658, 196	3 09	10, 463, 296	22, 442, 842	2 14	8, 628, 619	14, 722, 541	1 70
Delaware	698, 115	1, 201, 644	1 72	637, 065	817, 883	1 28	580, 862	510, 279	87
Maryland	2, 914, 007	5, 268, 676	1 80	3, 002, 267	4, 010, 529	1 33	2, 797, 905	2, 463, 443	88
Virginia	8, 165, 040	4, 924, 036	60	11, 437, 821	9, 392, 296	82	10, 360, 135	7, 021, 772	67
North Carolina	5, 258, 742	4, 082, 111	77	6, 517, 284	5, 873, 942	90	5, 453, 975	3, 931, 532	72
South Carolina	3, 010, 539	2, 282, 946	75	4, 572, 060	6, 151, 657	1 34	4, 072, 651	4, 136, 354	1 01
Georgia	6, 831, 856	4, 614, 701	67	8, 062, 758	6, 844, 387	84	6, 378, 479	5, 894, 150	92
Florida	736, 172	505, 074	68	654, 213	900, 669	1 37	349, 049	658, 795	1 88
Alabama	5, 062, 204	3, 286, 924	64	6, 385, 724	7, 433, 178	1 16	4, 435, 614	5, 125, 663	1 15
Mississippi	4, 209, 146	4, 456, 633	1 05	5, 065, 755	8, 826, 512	1 74	3, 444, 358	5, 762, 927	1 67
Louisiana	2, 045, 640	7, 159, 333	3 49	2, 707, 108	18, 648, 225	6 88	1, 590, 025	11, 576, 938	7 28
Texas	2, 964, 836	3, 396, 793	1 14	2, 650, 781	6, 259, 452	2 36	643, 976	2, 151, 704	3 34
Arkansas	1, 859, 821	2, 237, 409	1 20	1, 983, 313	4, 175, 326	2 10	781, 530	1, 601, 296	2 04
Tennessee	6, 843, 278	8, 199, 487	1 19	6, 795, 337	8, 465, 792	1 24	5, 175, 173	5, 360, 210	1 03
West Virginia	2, 580, 254	2, 112, 937	81						
Kentucky	8, 103, 850	8, 572, 896	1 05	7, 644, 208	7, 474, 573	97	5, 968, 270	5, 169, 037	86
Ohio	14, 469, 133	25, 692, 787	1 77	12, 625, 394	17, 538, 832	1 38	9, 851, 493	12, 750, 585	1 29
Michigan	5, 096, 939	13, 711, 979	2 69	3, 476, 296	5, 819, 832	1 67	1, 929, 110	2, 891, 371	1 49
Indiana	10, 104, 279	17, 676, 591	1 74	8, 242, 183	10, 457, 897	1 26	5, 046, 543	6, 704, 444	1 32
Illinois	19, 329, 952	34, 576, 587	1 78	13, 096, 374	17, 235, 472	1 31	5, 039, 545	6, 405, 561	1 27
Wisconsin	5, 899, 343	14, 239, 364	2 41	3, 746, 167	5, 758, 847	1 53	1, 045, 499	1, 641, 568	1 56
Minnesota	2, 322, 102	6, 721, 120	2 89	556, 250	1, 018, 183	1 83			
Iowa	9, 396, 467	20, 509, 582	2 19	3, 792, 792	5, 327, 033	1 40	824, 682	1, 172, 869	1 42
Missouri	9, 130, 615	15, 596, 426	1 70	6, 246, 871	8, 711, 508	1 39	2, 938, 425	3, 981, 525	1 35
Kansas	1, 971, 003	4, 053, 312	2 05	405, 468	727, 694	1 79			
Nebraska	647, 031	1, 549, 716	2 39						
California	6, 218, 133	5, 316, 690	85	2, 468, 034	2, 558, 506	1 03	32, 454	103, 483	3 18
Oregon	1, 116, 290	1, 293, 717	1 15	896, 414	952, 313	1 06			
Nevada	92, 644	163, 718	1 76						

The distribution of farm implements, as shown in the first of these tables, places New Jersey in the front rank, the basis of comparison being the proportion of value to each acre of farm land, New York, Pennsylvania, and Massachusetts following in order; but a fairer comparison would be the proportion of value to the "improved" acre, as the farm implements have relation mainly to the area in cultivation, and very little to that in commons and woodlands; and this comparison is made not only for 1870, but for the enumerations of 1860 and 1850. In that of 1860 Louisiana stands first, (on account of expensive machinery and apparatus for sugar-making,) followed by New Jersey, Pennsylvania, New York, Minnesota, Massachusetts, Rhode Island, Michigan, &c.

VALUE PER ACRE OF FARM PRODUCTS.—The following table gives the average value proportioned both to each acre of the farm and to each acre of improved land. The large figure for Wyoming, $126.50, is due to the fact that the improved farm lands have a very small area, and immense herds of cattle feed upon public lands.

Statement showing the value of farm products, and the average value produced for each acre of farm land, and for each acre of improved land in farms.

States and Territories.	Value of land in farms.	Value of farm products.	Value of products per acre.	Value of products per acre of improved land.
Maine	$102, 961, 951	$33, 470, 044	$6 15	$11 47
New Hampshire	80, 589, 313	22, 473, 547	6 23	9 62
Vermont	139, 367, 075	34, 647, 027	7 65	11 27
Massachusetts	116, 432, 784	32, 192, 378	11 79	18 54
Rhode Island	21, 574, 968	4, 761, 163	9 47	16 47
Connecticut	124, 241, 382	26, 482, 150	11 20	16 08
New York	1, 272, 857, 766	253, 526, 153	11 42	16 22
New Jersey	257, 523, 376	42, 725, 198	14 29	21 61
Pennsylvania	1, 043, 481, 582	183, 946, 027	10 22	15 97
Delaware	46, 712, 870	8, 171, 667	7 76	11 70
Maryland	170, 369, 684	35, 343, 927	7 83	12 12
Virginia	213, 020, 845	51, 774, 801	2 85	6 34
North Carolina	78, 211, 083	57, 845, 940	2 86	10 99
South Carolina	44, 808, 763	41, 909, 402	3 46	13 92
Georgia	94, 559, 468	80, 390, 228	3 39	11 76
Florida	9, 947, 920	8, 909, 746	3 75	12 10
Alabama	67, 739, 036	67, 522, 335	4 51	13 33
Mississippi	81, 716, 576	73, 137, 953	5 57	17 37
Louisiana	68, 215, 421	52, 006, 622	7 40	25 42
Texas	60, 149, 950	49, 185, 170	2 67	16 58
Arkansas	40, 029, 698	40, 701, 699	5 35	21 88
Tennessee	218, 743, 747	86, 472, 847	4 41	12 63
West Virginia	101, 604, 381	23, 379, 692	2 74	9 06
Kentucky	311, 238, 916	87, 477, 374	4 68	10 79
Missouri	392, 908, 047	103, 035, 759	4 74	11 28
Illinois	920, 506, 346	210, 860, 585	8 14	10 90
Indiana	634, 804, 189	122, 914, 302	6 78	12 16
Ohio	1, 054, 465, 226	198, 256, 907	9 13	13 70
Michigan	398, 240, 578	81, 508, 623	8 13	15 99
Wisconsin	300, 414, 064	78, 027, 032	6 66	13 22
Minnesota	97, 847, 442	33, 446, 400	5 15	14 40
Iowa	392, 662, 441	114, 386, 441	7 35	12 17
Kansas	90, 327, 040	27, 630, 651	4 88	14 01
Nebraska	30, 242, 186	8, 604, 742	4 14	13 29
California	141, 240, 028	49, 856, 024	4 36	8 01
Oregon	22, 352, 989	7, 122, 790	2 98	6 38
Nevada	1, 485, 505	1, 659, 713	7 95	17 91
Colorado Territory	3, 385, 748	2, 335, 106	7 28	24 42
Utah Territory	2, 297, 922	1, 973, 142	13 29	16 61
New Mexico Territory	2, 260, 139	1, 905, 060	2 28	13 32
Washington Territory	3, 978, 341	2, 111, 902	3 25	10 99
Dakota Territory	2, 085, 265	495, 657	1 63	11 62
Montana Territory	729, 193	1, 676, 660	12 01	19 80
Idaho Territory	492, 860	637, 797	8 26	23 97
Arizona Territory	161, 340	277, 998	12 74	19 06
Wyoming Territory	18, 187	42, 760	9 85	126 50

Statement showing the distribution of farm animals in proportion to population in the several States in 1860 *and* 1870.

States and Territories.	1870.						1860.					
	Population.	Number of animals to each 100 inhabitants.					Population.	Number of animals to each 100 inhabitants.				
		Horses.	Milch cows.	Oxen and other cattle.	Sheep.	Swine.		Horses.	Milch cows.	Oxen and other cattle.	Sheep.	Swine.
Maine	626, 915	11	22	32	69	7	628, 279	9	23	36	72	8
New Hampshire	318, 300	12	28	41	78	10	326, 073	12	29	52	95	15
Vermont	330, 551	19	54	42	175	14	315, 098	21	55	62	238	16
Massachusetts	1, 457, 351	2	7	7	5	3	1, 231, 066	3	11	11	9	6
Rhode Island	217, 353	3	8	7	11	6	174, 620	4	11	11	18	10
Connecticut	537, 454	6	18	22	15	9	460, 147	7	21	31	25	16
New York	4, 382, 759	12	30	15	49	11	3, 880, 735	12	28	21	67	23
New Jersey	906, 096	8	13	7	13	15	672, 035	11	20	14	20	35
Pennsylvania	3, 521, 951	13	20	18	50	24	2, 906, 215	15	23	25	56	35
Delaware	125, 015	13	19	20	10	31	112, 216	14	20	31	16	42
Maryland	780, 894	11	12	16	16	33	687, 049	13	14	22	22	56
Virginia*	1, 225, 163	12	15	26	30	55	1, 219, 630	16	18	41	48	104
North Carolina	1, 071, 361	9	18	30	43	100	992, 622	15	23	46	55	189
South Carolina	705, 606	6	13	21	17	56	703, 708	11	23	48	33	137
Georgia	1, 184, 109	6	19	39	35	83	1, 057, 286	12	28	66	48	192
Florida	187, 748	5	32	175	14	84	140, 424	9	66	210	21	193
Alabama	996, 992	8	17	31	24	72	964, 201	13	23	56	38	181
Mississippi	827, 922	10	21	39	28	98	791, 305	14	26	60	44	193
Louisiana	726, 915	8	14	32	16	45	708, 002	11	18	54	25	89
Texas	818, 579	51	52	374	87	146	604, 215	53	99	485	124	226
Arkansas	484, 471	18	26	47	33	173	435, 450	32	39	91	46	269
Tennessee	1, 258, 520	19	19	31	65	145	1, 109, 801	26	22	46	69	211
West Virginia*	442, 014	20	23	44	124	60	376, 688	22	26	55	120	86
Kentucky	1, 321, 011	24	18	34	70	139	1, 155, 684	30	23	49	81	201
Ohio	2, 665, 260	22	24	29	184	64	2, 339, 511	26	28	40	151	96
Michigan	1, 184, 059	19	21	25	167	35	749, 113	18	23	40	169	49
Indiana	1, 680, 637	29	29	37	95	111	1, 350, 428	38	26	52	73	229
Illinois	2, 539, 891	33	25	42	61	106	1, 711, 951	32	30	61	44	146
Wisconsin	1, 054, 670	23	29	36	101	48	775, 881	14	26	41	42	43
Minnesota	439, 706	21	27	42	30	33	172, 023	9	23	45	7	58
Iowa	1, 194, 020	36	30	53	71	113	674, 913	25	28	51	38	138
Missouri	1, 721, 295	28	23	43	78	134	1, 182, 012	30	29	69	79	199
Kansas	364, 399	32	33	68	29	56	107, 206	18	26	60	16	128
Nebraska	122, 993	24	23	41	18	40	28, 841	15	24	104	8	88
California	560, 247	34	29	83	494	79	379, 994	42	54	256	286	120
Oregon	90, 923	56	53	79	352	131	52, 465	70	101	192	164	155
Nevada	42, 491	17	14	59	26	7	6, 857	7	13	66	5	52
Utah Territory	86, 786	12	20	24	68	3	40, 273	11	29	55	92	16
New Mexico Territory	91, 874	5	17	44	674	12	93, 516	10	36	58	887	11
Washington Territory	23, 955	46	70	126	184	73	11, 594	41	83	163	88	55
Dakota Territory	14, 181	20	29	58	13	14	4, 837	2	6	11	4	6

* Virginia in 1860 is restricted to its present boundaries for the purpose of comparison, and West Virginia in 1870 is compared with the same area in 1860.

Could a comparison be made based upon the aggregate numbers of all domestic animals, instead of those on the farm returned by the census, the showing in the preceding table would be more favorable than it is. It appears that Oregon takes precedence in the number of horses in proportion to population, Texas coming next; Washington Territory in milch cows, Vermont taking the second place; Texas in other cattle; New Mexico in sheep, followed respectively by California and Oregon; Arkansas in swine, Texas and Tennessee following in order.

FARM PRODUCTS PROPORTIONED TO POPULATION.—The following table presents an idea of the comparative rate of production of several staple products of the farm. It should not be forgotten, however, that the corn crop in 1869 was a partial failure, and the wheat crop of that year a great success; so that a decline or an advance in production is not necessarily proved by the figures presented. Iowa stands at the head of corn producing States, and Minnesota grows the most wheat in proportion to population, (about 43 bushels to each inhabitant;) Minnesota also stands first in the growth of oats, and Vermont is first in the production of hay.

Proportion of bushels of corn, wheat, and oats, and tons of hay, produced in each State, to each 100 *of the population, in the years* 1859 *and* 1869, *respectively.*

States.	Corn.		Wheat.		Oats.		Hay.	
	1859.	1869.	1859.	1869.	1859.	1869.	1859.	1869.
	Bush.	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Tons.*	*Tons.*
Maine	246	173	37	44	475	37	155. 33	168. 03
New Hampshire	433	401	73	60	407	360	197. 15	192. 47
Vermont	484	514	138	137	1, 152	1, 089	298. 46	308. 82
Massachusetts	175	95	9	2. 3	95	54	54. 04	40. 99
Rhode Island	264	143	0. 6	0. 3	140	72	47. 32	40. 97
Connecticut	447	292	11	7	330	207	122. 23	104. 82
New York	516	375	223	277	906	805	91. 85	128. 09
New Jersey	1, 446	965	262	254	675	442	75. 70	57. 61
Pennsylvania	970	985	448	558	942	1, 035	77. 26	80. 87
Delaware	3, 469	2, 408	813	716	933	443	32. 95	33. 51
Maryland	1, 957	1, 498	888	739	576	412	27. 90	28. 57
Virginia	2, 497	1, 440	887	603	700	559	23. 86	16. 31
North Carolina	3, 030	1, 722	477	266	280	300	18. 27	7. 79
South Carolina	2, 140	1, 079	182	111	133	86	12. 44	1. 51
Georgia	2, 911	1, 490	240	179	116	160	4. 39	. 88
Florida	2, 018	1, 185	2	....	33	60	8. 17	....
Alabama	3, 445	1, 703	126	105	70	77	6. 45	1. 06
Mississippi	3, 672	1, 888	74	33	27	50	4. 15	1. 00
Louisiana	2, 380	1, 045	4. 5	1. 3	12	2. 4	7. 44	1. 20
Texas	2, 731	2, 511	244	50	163	93	1. 96	2. 32
Arkansas	4, 093	2, 762	219	153	109	109	2. 14	1. 41
Tennessee	4, 693	3, 285	491	491	204	358	12. 93	9. 26
West Virginia	2, 086	1, 854	611	561	437	546	40. 92	50. 71
Kentucky	5 542	3, 791	639	433	399	501	13. 71	15. 47
Ohio	3, 143	2, 532	646	1, 046	650	951	66. 87	85. 90
Michigan	1, 661	1, 189	1, 112	1, 373	538	756	102. 55	109. 03
Indiana	5, 301	3, 040	1, 247	1, 651	393	511	46. 09	64. 07
Illinois	6, 727	5, 115	1, 392	1, 186	889	1, 684	103. 65	108. 17
Wisconsin	968	1, 425	2, 018	2, 428	1, 425	1, 913	110. 21	122. 09
Minnesota	1, 710	1, 078	1, 271	4, 290	1, 265	2, 428	104. 35	158. 07
Iowa	6, 283	5, 773	1, 251	2, 465	872	1, 759	120. 48	148. 85
Missouri	6, 159	3, 836	357	831	311	963	33. 93	35. 76
Kansas	5, 737	4, 673	181	656	82	1, 124	52. 45	134. 58
Nebraska	5, 146	3, 854	513	1, 729	258	1, 202	84. 92	137. 79
California	134	217	1, 560	2, 976	274	313	80. 45	98. 49
Oregon	145	79	1, 577	2, 575	1, 690	2, 233	53. 40	82. 90
Nevada	6	22	53	539	15	131	32. 54	79. 84
The Territories	348	268	354	416	91	247	11. 16	28. 43

FARM PRODUCTS PROPORTIONED TO IMPROVED LAND.—This table shows, not the yield per acre, but the comparative prominence of these

crops in the farm systems of the respective States—the aggregate of each crop divided by the total number of acres of improved land. In this regard Kansas occupies the first place in the production of corn, growing 8.63 bushels to each acre improved; Minnesota, in wheat; Minnesota, in oats; and Nevada, in hay, followed by Maine. Kansas was also first in corn production in 1869, and Utah first in wheat-growing.

Proportion of bushels of corn, wheat, oats, and tons of hay to each acre of improved land, for the several States, in the years 1859 *and* 1869, *respectively.*

States and Territories.	Census of 1870.				Census of 1860.			
	Product of corn per acre of improved land.	Product of wheat per acre of improved land.	Product of oats per acre of improved land.	Product of hay per acre of improved land.	Product of corn per acre of improved land.	Product of wheat per acre of improved land.	Product of oats per acre of improved land.	Product of hay per acre of improved land.
	Bush.	*Bush.*	*Bush.*	*Tons.*	*Bush.*	*Bush.*	*Bush.*	*Tons.*
Maine	.37	.09	.80	.361	.57	.08	1.10	.360
New Hampshire	.54	.08	.49	.262	.59	.10	.56	.271
Vermont	.55	.14	1.17	.332	.54	.15	1.28	.333
Massachusetts	.80	.01	.45	.344	1.00	.05	.54	.308
Rhode Island	1.07	......	.54	.308	1.37	......	.72	.246
Connecticut	.95	.02	.67	.342	1.12	.02	.83	.307
New York	1.05	.77	2.25	.359	1.39	.60	2.44	.248
New Jersey	4.42	1.16	2.02	.264	4.76	.90	2.33	.261
Pennsylvania	3.01	1.70	3.16	.247	2.69	1.24	2.61	.214
Delaware	4.31	1.28	.79	.060	6.10	1.43	1.64	.050
Maryland	4.01	1.98	1.10	.076	4.47	2.03	1.31	.063
Virginia	2.16	.90	.83	.024	3.35	1.14	.89	.038
North Carolina	3.50	.54	.61	.015	4.61	.72	.42	.027
South Carolina	2.52	.26	.20	.003	3.29	.28	.20	.019
Georgia	2.58	.31	.27	.001	3.81	.31	.15	.005
Florida	3.02	......	.15	......	4.33	......	.07	.017
Alabama	3.35	.21	.15	.002	5.20	.19	.10	.009
Mississippi	3.71	.06	.09	.001	5.73	.11	.04	.006
Louisiana	3.71	......	......	.004	6.22	.01	.03	.019
Texas	6.93	.14	.25	.006	6.22	.56	.37	.004
Arkansas	7.19	.39	.28	.003	8.98	.48	.23	.004
Tennessee	6.04	.90	.60	.017	7.66	.80	.33	.021
West Virginia	3.17	.96	.93	.086	......	......	......	......
Kentucky	6.18	.70	.81	.037	8.37	.96	.60	.020
Ohio	4.66	1.92	1.75	.158	5.82	1.19	1.22	.123
Michigan	2.76	3.19	1.75	.253	3.57	2.39	1.16	.220
Indiana	5.05	2.74	.85	.106	8.68	2.04	.64	.075
Illinois	6.72	1.55	2.21	.142	8.79	1.82	1.16	.135
Wisconsin	2.54	4.34	3.42	.218	2.00	4.17	2.95	.227
Minnesota	2.04	8.10	4.59	.297	5.28	3.93	3.90	.322
Iowa	7.33	3.13	2.23	.189	11.18	2.22	1.55	.214
Missouri	7.23	1.56	1.81	.067	11.66	.67	.58	.064
Kansas	8.63	1.21	2.07	.248	15.16	.47	.21	.138
Nebraska	7.32	3.28	2.28	.261	12.47	1.24	.62	.205
California	.19	2.68	.28	.088	.20	2.40	.42	.123
Oregon	.06	2.09	1.80	.067	.08	.90	.98	.312
Nevada	.10	2.47	.60	.365	......	.25	.07	.156
Colorado Territory	2.42	2.70	3.48	.206	......	......	......	......
Utah Territory	.80	4.70	.55	.229	1.17	4.98	.81	249
New Mexico Territory	4.48	2,46	.47	.029	4.51	2.90	.04	.007
Washington Territory	.11	1.13	1.32	.157	.05	1.05	1.64	005
Dakota Territory	3.12	4.00	2.68	.312	9.58	.44	1.20	.400
Montana Territory	......	2.13	1.76	.221	......	......	......	......
Idaho Territory	.21	2.84	3.75	.262	......	......	......	......
Arizona Territory	2.19	1.85	......	.007	......	......	......	......

DISTRIBUTION OF FARM ANIMALS.—The small area of improved land in Wyoming, and the large number of farm animals kept on public land, explain the anomalous figures representing that Territory. The proportion for other Territories is affected to some extent by the same causes. Of the States, Texas has the largest proportion of horses; Louisiana, of mules; Texas, of cattle; California, of sheep, and Arkansas, of swine.

The following table presents the

Number of horses, mules and asses, cattle, sheep, and swine, to one hundred acres of improved land in the several States and Territories in 1870.

States and Territories.	Horses.	Mules.	Oxen and other cattle.	Milch cows.	Sheep.	Swine.
Maine	2.4	....	6.9	4.7	14.8	1.5
New Hampshire	1.6	....	5.6	3.8	10.6	1.4
Vermont	2.1	....	4.5	5.8	18.8	1.5
Massachusetts	2.3	....	6.0	6.6	4.5	2.8
Rhode Island	2.6	....	5.3	6.5	8.2	5.0
Connecticut	2.1	....	7.2	6.0	5.0	3.1
New York	3.4	....	4.4	8.6	13.9	3.3
New Jersey	4.0	0.4	3.2	6.7	6.0	7.2
Pennsylvania	3.9	0.1	5.5	6.1	15.5	7.5
Delaware	2.4	0.5	3.7	3.4	3.2	5.7
Maryland	3.0	0.3	4.1	3.2	4.4	8.8
Virginia	1.8	0.3	3.9	2.3	4.5	8.2
North Carolina	1.9	0.9	6.1	3.7	8.8	20.4
South Carolina	1.4	1.3	5.0	3.2	4.1	13.1
Georgia	1.1	1.2	6.8	3.3	6.1	14.4
Florida	1.6	1.2	44.6	8.4	3.6	21.5
Alabama	1.5	1.5	6.2	3.3	4.7	14.2
Mississippi	2.1	2.0	7.7	4.1	5.5	19.3
Louisiana	2.9	2.9	11.3	4.9	5.7	16.5
Texas	14.3	2.0	103.4	14.4	24.0	40.5
Arkansas	4.9	1.9	12.3	6.9	8.6	45.2
Tennessee	3.6	1.5	5.8	3.5	12.0	26.7
West Virginia	3.5	....	7.6	4.0	21.4	10.3
Kentucky	3.9	1.2	5.5	3.0	11.5	22.6
Ohio	4.2	0.1	5.4	4.5	34.0	11.9
Michigan	4.4	....	5.8	4.9	38.9	8.1
Indiana	4.9	0.4	6.2	3.8	15.9	18.5
Illinois	4.4	0.4	5.5	3.3	8.1	13.9
Wisconsin	4.2	....	6.5	5.2	18.1	8.6
Minnesota	4.0	0.1	8.1	5.2	5.6	6.3
Iowa	4.6	0.2	6.7	3.9	9.1	14.4
Missouri	5.4	1.2	8.2	4.3	14.8	25.2
Kansas	5.9	0.5	12.7	6.2	5.5	10.4
Nebraska	4.7	0.4	7.8	4.4	3.5	9.1
California	3.0	0.2	7.5	2.6	44.5	7.1
Oregon	4.6	0.2	64.3	4.3	28.4	10.7
Nevada	8.1	1.0	27.3	6.6	11.8	3.5
Colorado Territory	6.7	1.2	47.8	26.1	126.5	5.7
Utah Territory	9.3	2.4	18.2	14.7	50.2	2.6
New Mexico Territory	3.5	4.2	28.7	11.4	433.1	7.8
Washington Territory	5.8	0.4	15.7	8.8	22.9	9.1
Dakota Territory	5.8	0.5	19.5	9.7	4.4	4.7
Montana Territory	6.2	0.5	28.7	14.6	2.3	3.0
Idaho Territory	8.0	1.3	23.6	15.6	3.8	8.7
Arizona Territory	2.2	2.7	28.7	6.4	5.5	4.9
Wyoming Territory	172.7	83.7	3,083.7	209.1	1,896.1	43.1

HORSES AND CATTLE NOT ON FARMS.—The census returns of domestic animals include only those on farms. No provision is made for enumeration of horses, cattle, or other animals kept for work, milk, or for fattening, in cities, or those *in transitu* by rail or otherwise to the feeder or butcher. In 1860 some effort was made to obtain *data* from towns, which were published in separate tables. The superintendent of the present census has sought all available facts of a positive character, and made an estimate of the horses and cattle not on farms, which are added to those returned from farms, as follows:

Number of horses and neat cattle, as returned by census enumeration, with estimates of those "not on farms."

States and Territories.	HORSES.			NEAT CATTLE.		
	Total.	On farms.	Not on farms.	Total.	On farms.	Not on farms.
Alabama	92, 807	78, 962	13, 845	500, 206	471, 893	28, 313
Arizona Territory	4, 432	335	4, 097	38, 632	5, 132	33, 500
Arkansas	102, 240	92, 013	10, 227	379, 023	357, 935	21, 088
California	241, 146	192, 273	48, 873	669, 280	631, 398	37, 882
Colorado Territory	13, 317	6, 446	6, 871	159, 456	70, 736	88, 720
Connecticut	54, 139	34, 935	19, 204	231, 094	218, 013	13, 081
Dakota Territory	3, 243	2, 514	729	56, 724	12, 467	44, 257
Delaware	18, 633	16, 770	1, 863	53, 990	49, 990	4, 000
District of Columbia	6, 029	533	5, 496	1, 801	801	1, 000
Florida	14, 451	11, 902	2, 549	453, 451	390, 915	62, 536
Georgia	110, 237	81, 777	28, 460	809, 667	697, 903	111, 764
Idaho Territory	2, 775	2, 151	624	59, 996	10, 456	49, 540
Illinois	1, 017, 646	853, 738	163, 908	1, 944, 573	1, 715, 586	228, 987
Indiana	553, 203	497, 883	55, 320	1, 182, 988	1, 026, 084	156, 804
Iowa	482, 786	433, 642	49, 144	1, 137, 045	1, 006, 235	130, 810
Kansas	152, 000	117, 786	34, 214	998, 347	373, 967	624, 380
Kentucky	351, 200	317, 034	34, 166	812, 380	700, 327	112, 053
Louisiana	62, 584	59, 025	3, 559	383, 364	330, 532	52, 832
Maine	79, 782	71, 514	8, 268	428, 826	343, 061	85, 765
Maryland	102, 216	89, 696	12, 520	231, 399	215, 359	16, 040
Massachusetts	86, 266	41, 039	45, 227	271, 315	219, 052	52, 263
Michigan	253, 670	228, 302	25, 368	635, 134	547, 529	87, 605
Minnesota	102, 678	93, 011	9, 667	365, 241	310, 379	54, 862
Mississippi	104, 600	90, 221	14, 379	581, 247	501, 075	80, 172
Missouri	545, 822	493, 969	51, 853	1, 269, 065	1, 153, 695	115, 370
Montana Territory	6, 733	5, 289	1, 444	82, 380	36, 738	45, 642
Nebraska	33, 901	30, 511	3, 390	392, 716	79, 928	312, 788
Nevada	14, 400	7, 520	6, 880	40, 969	31, 516	9, 453
New Hampshire	43, 335	39, 095	4, 240	236, 169	222, 801	13, 368
New Jersey	103, 663	79, 708	23, 955	229, 086	197, 488	31, 598
New Mexico Territory	26, 500	5, 033	21, 467	186, 301	57, 534	128, 767
New York	856, 241	536, 861	319, 380	2, 086, 230	2, 045, 324	40, 906
North Carolina	114, 406	102, 768	11, 643	618, 263	521, 162	97, 101
Ohio	704, 664	609, 722	94, 942	1, 521, 421	1, 436, 217	85, 204
Oregon	64, 625	51, 702	12, 923	150, 246	120, 197	30, 049
Pennsylvania	611, 488	460, 339	151, 149	1, 505, 897	1, 344, 551	161, 346
Rhode Island	11, 113	7, 770	3, 343	40, 105	34, 375	5, 730
South Carolina	54, 052	44, 105	9, 947	289, 207	249, 303	39, 904
Tennessee	273, 200	247, 254	25, 946	682, 318	643, 696	38, 622
Texas	574, 641	424, 504	150, 137	3, 990, 158	3, 494, 043	496, 115
Utah Territory	14, 281	11, 068	3, 213	190, 934	39, 180	151, 754
Vermont	69, 015	65, 015	4, 000	346, 501	320, 835	25, 666
Virginia	168, 938	152, 899	16, 039	573, 152	511, 743	61, 409
Washington Territory	13, 923	11, 138	2, 785	51, 979	47, 254	4, 725
West Virginia	99, 362	90, 479	8, 883	337, 881	301, 680	36, 201
Wisconsin	270, 083	252, 019	18, 064	831, 953	693, 294	138, 659
Wyoming Territory	3, 753	584	3, 169	36, 472	11, 130	25, 342

In 1860 the assistant marshals made some effort to ascertain approximately the number of cattle and horses in cities and towns, resulting in a total of 3,347,009 cattle not on farms and 1,185,514 horses. This was above 11 per cent. of all the cattle reported, and 16 per cent. of all the horses. In 1870 the estimates of cattle and horses not on farms were: cattle, 4,273,973; horses, 1,547,370. This was 15 per cent. of all the cattle, and nearly 18 per cent. of the total number of horses reported. In Massachusetts the estimate of horses in towns is 45,227, and the returns from farms aggregate 41,039; in New Mexico, the estimate is 21,467 against 5,033 on farms; and in Colorado, 6,871 against 6,446 on farms. The number returned from cities and towns in New York is 319,380.

Number and average size of the farms in the several States and Territories.

States and Territories.	FARMS.			AVERAGE SIZE OF FARMS.		
	Total number.			Acres.		
	1870.	1860.	1850.	1870.	1860.	1850.
Maine	59, 804	55, 698	46, 760	98	103	97
New Hampshire	29, 642	30, 501	29, 229	122	123	116
Vermont	33, 827	31, 556	29, 763	134	135	139
Massachusetts	26, 500	35, 601	34, 069	103	94	99
Rhode Island	5, 368	5, 406	5, 385	94	96	103
Connecticut	25, 508	25, 180	22, 445	93	99	106
New York	216, 253	196, 990	170, 621	103	106	112
New Jersey	30, 652	27, 646	23, 905	98	108	115
Pennsylvania	174, 041	156, 357	127, 577	103	109	117
Delaware	7, 615	6, 658	6, 063	138	151	158
Maryland	27, 000	25, 494	21, 860	167	190	212
Virginia	73, 849	92, 605	77, 013	246	324	340
North Carolina	93, 565	75, 203	56, 963	212	316	369
South Carolina	51, 889	33, 171	29, 967	233	488	541
Georgia	69, 956	62, 003	51, 759	338	430	441
Florida	10, 241	6, 568	4, 304	232	444	371
Alabama	67, 382	55, 128	41, 964	222	346	289
Mississippi	68, 023	42, 840	33, 960	193	370	309
Louisiana	28, 481	17, 328	13, 422	247	536	372
Texas	61, 125	42, 891	12, 198	301	591	942
Arkansas	49, 424	39, 004	17, 758	154	245	146
Tennessee	118, 141	82, 368	72, 735	166	251	261
West Virginia	39, 778	....	....	214	....	....
Kentucky	118, 422	90, 814	74, 777	158	211	227
Ohio	195, 953	179, 889	143, 807	111	114	125
Michigan	98, 786	62, 422	34, 089	101	113	129
Indiana	161, 289	131, 826	93, 896	112	124	136
Illinois	202, 803	143, 310	76, 208	128	146	158
Wisconsin	102, 904	69, 270	20, 177	114	114	148
Minnesota	46, 500	18, 181	157	139	149	184
Iowa	116, 292	61, 163	14, 805	134	165	185
Missouri	148, 328	92, 792	54, 458	146	215	179
Kansas	38, 202	10, 400	....	148	171	....
Nebraska	12, 301	2, 789	....	169	226	....
California	23, 724	18, 716	872	482	466	4, 466
Oregon	7, 587	5, 806	1, 164	315	355	372
Nevada	1, 036	91	....	201	617	....
Arizona Territory	172	....	....	127	....	....
Colorado Territory	1, 738	....	....	184	....	....
Dakota Territory	1, 720	123	....	176	215	....
Idaho Territory	414	....	....	186	....	....
Montana Territory	851	....	....	164	....	....
New Mexico Territory	4, 480	5, 086	3, 750	186	278	77
Utah Territory	4, 908	3, 635	926	30	25	51
Washington Territory	3, 127	1, 330	....	208	275	....
Wyoming Territory	175	....	....	25	....	....

This table shows a falling off in the number of farms in several of the States. This decrease amounts to 859 in New Hampshire, 9,101 in Massachusetts, 38 in Rhode Island, and 606 in New Mexico. In New Hampshire some farms have been abandoned, and do not appear in the returns; in Massachusetts, the average size having increased from 94 to 103 acres, consolidation of farms must have occurred; some hill farms may not have been occupied, and others have been absorbed by extension of town building sites.

A considerable increase in the number of farms has occurred in the Middle States—19,263 in New York, 3,006 in New Jersey, 17,684 in Pennsylvania, and 957 in Delaware. A large increase is noted in the Southern States, especially in the cotton States. It amounts to 18,362 in North Carolina, 18,718 in South Carolina, 7,953 in Georgia, 3,673 in Florida, 12,254 in Alabama, 25,183 in Mississippi, 11,153 in Louisiana, 18,234 in Texas, 10,420 in Arkansas, and 35,773 in Tennessee. A large increase of farms appear in the West. Illinois has gained 59,493, at the rate of 41 per cent.; Iowa, 55,129, or 90 per cent.; Minnesota,

28,319, or 155 per cent.; and Kansas, 27,802, or 267 per cent. The other western States have also made a very large increase. On the Pacific coast, California has made an increase of 5,008, or 27 per cent.; and yet her farms have increased in size from 466 to 482 acres; Oregon 1,781, or 30 per cent.

The whole number of farms reported is 2,659,985, an increase of 615,908 in ten years. The increase between 1850 and 1860 was 595,004. The larger States stand in the following order, as to number of farms: New York, 216,253; Illinois, 202,803; Ohio, 195,953; Pennsylvania, 174,041; Indiana, 161,289; Missouri, 148,328; Kentucky, 118,422; Tennessee, 118,141.

The size of farms appears to be reduced in all States excepting Massachusetts, which has increased from 94 to 103; California, from 466 to 482; and Wisconsin, where the average is the same as in 1860, 114 acres.

The reduction of size is heavy in the Southern States; *e. g.* from 316 to 212 in North Carolina; from 488 to 233 in South Carolina; from 370 to 193 in Mississippi; from 591 to 301 in Texas. In the Western States the difference is less marked; the reduction in Illinois being from 146 to 128; in Ohio, from 114 to 111; in Kentucky, from 211 to 158; in Iowa, from 165 to 134; in Nebraska, from 226 to 169.

MARKET PRICES OF FARM

The following quotations represent the state of

Products.	January.	February.	March.	April.	May.
NEW YORK.					
Flour, State	$5 35 to $5 65	$6 20 to $7 30	$6 00 to $7 35	$6 00 to $7 10	$5 75 to $6 70
western	5 35 to 8 25	6 20 to 8 75	6 00 to 8 75	6 00 to 9 00	6 10 to 9 00
Wheat, spring	1 27 to 1 43	1 49 to 1 57	1 45 to 1 56	1 45 to 1 61	1 43 to 1 50
winter, red and amber, western	1 46 to 1 48	1 59 to 1 60	1 61 to 1 64	1 54 to 1 68	1 50 to 1 53
Corn, western, mixed	76 to 77	88 to 91	84 to 86½	83 to 84	76 to 79
Rye	90 to 1 05	1 13½	1 12½	1 12½	Nominal.
Barley	78 to 1 10	1 10	1 05 to 1 18	95	Nominal.
Oats, western, mixed	60 to 62	62½ to 65	66 to 70	64½ to 71	65 to 68
Hay, shipping qualities	23 00 to 24 00	25 00 to 26 00	24 00	24 00	22 30
prime	24 00 to 27 00	26 00 to 28 00	25 00 to 30 00	25 00 to 30 00	24 00 to 29 00
Pork, mess	19 25 to 19 50	21 75 to 23 00	21 50 to 22 25	21 25	18 00 to 18 50
prime mess	20 00 to 21 00	21 50 to 22 00	19 00 to 22 00	18 00 to 20 00	16 00 to 16 50
Beef, mess	10 00 to 15 00	10 00 to 15 00	10 00 to 15 00	10 00 to 15 00	10 00 to 15 00
extra	15 00 to 18 00	15 00 to 17 50	15 00 to 17 50	15 00 to 17 50	15 00 to 17 50
Lard	11¼ to 12¼	12 to 13⅛	12¼ to 13⅓	11½ to 12¼	10¼ to 11¾
Butter, western	12 to 25	12 to 22	15 to 25	12 to 20	12 to 30
State	20 to 45	20 to 45	30 to 48	20 to 45	20 to 34
Cheese, dairy	7 to 14	7 to 14	7 to 14	7 to 14	7 to 12
factory	13 to 16¼	13 to 15¾	13 to 16½	12 to 16½	8 to 15
Cotton, ordinary	12⅝ to 13⅝	13¼ to 15¼	12⅛ to 14	10⅜ to 13⅓	10½ to 13¼
middling	15¼ to 16	14⅞ to 17⅛	14⅛ to 17⅛	14 to 17⅓	14 to 16½
Tobacco, sound lugs	7 to 8¾	7 to 8¼	6¼ to 8¼	6 to 7½	5¼ to 6½
common to medium leaf	7¼ to 9¾	7¼ to 9	7½ to 9	7 to 8½	6 to 7¾
Wool, X Ohio	46 to 49	47½ to 53	50 to 53	49 to 54	50 to 54
XX Ohio	50 to 52	53 to 54	54 to 55	55	56 to 56½
pulled	37 to 41	38 to 45	35 to 50	35 to 51	47½ to 52½
Texas	20 to 24	21½ to 24	24 to 30	34	24 to 36
California	33½ to	21 to 26	26 to 36	25 to 40	24 to 36
BOSTON.					
Flour, superfine	5 75 to 5 50	6 05 to 6 25	6 00 to 6 50	6 25 to 6 50	5 75 to 6 00
extra	6 00 to 7 50	6 50 to 7 50	6 75 to 8 00	6 75 to 7 75	6 75 to 7 75
choice	7 50 to 10 00	7 50 to 10 00	8 00 to 10 75	8 50 to 10 50	8 00 to 10 75
Wheat	1 10 to 1 60	1 50 to 1 80	1 50 to 1 80	1 50 to 1 80	1 50 to 1 80
Corn, yellow	84 to 86	91 to 93	85 to 88	89 to 91	83 to 84
mixed	82 to 84	87 to 90	83 to 85	86 to 88	80 to 82
Oats	60 to 65	65 to 70	68 to 73	70 to 74	63 to 69
Rye	1 10 to 1 15	1 15 to 1 20	1 15 to 1 20	1 15 to 1 20	1 10 to 1 20
Barley	90 to 1 20	95 to 1 20	1 00 to 1 20	95 to 1 20	95 to 1 20
Hay	19 00 to 29 00	20 00 to 27 00	19 00 to 29 00	19 00 to 29 00	20 00 to 23 00
Pork, mess	20 50 to 21 50	23 00 to 23 50	23 00 to 23 50	21 50 to 22 00	18 50 to 19 50
prime	16 00 to 18 00	19 00 to 19 50	19 00 to 19 50	18 00 to 18 50	16 00 to 17 00
Beef, mess	13 00 to 15 00	13 00 to 15 00	13 00 to 15 00	13 00 to 16 00	13 00 to 16 00
extra mess	15 00 to 20 00	16 00 to 21 50	16 00 to 21 50	16 00 to 21 50	16 00 to 21 00
Lard, tierce or barrel	13 to 13½	13½ to 14	13½ to 14	12½ to 13	12 to 12½
Butter, New York or Vermont.	25 to 39	28 to 40	28 to 42	20 to 42	15 to 35
Canada	20 to 33	20 to 37	20 to 39	20 to 25	15 to 20
western	13 to 20	16 to 28	16 to 28	14 to 25	12 to 25
Cheese, eastern factory	13½ to 16	13½ to 16	12½ to 16	10 to 16	10 to 15½
Ohio factory	13 to 15	13 to 15½	13 to 15½	13 to 15½	12 to 15
Wool, Ohio and Pennsylvania.	45 to 65	47 to 65	50 to 65	50 to 67½	50 to 70
Michigan	42 to 49	45 to 50	47 to 52	47 to 54½	48 to 55
other western	42 to 46	42 to 48	45 to 50	45 to 52	47 to 52
California	18 to 33	18 to 33	18 to 34	20 to 38	20 to 38
Texas	15 to 35	15 to 35	15 to 35	20 to 37	20 to 37
combing	52 to 58	52 to 58	52 to 60	55 to 60	55 to 60
pulled	25 to 48	25 to 52½	25 to 52½	30 to 57	35 to 60
CINCINNATI.					
Flour, family	5 60 to 5 65	6 00 to 6 25	6 50 to 6 75	6 35 to 6 50	6 25 to 6 50
extra	5 25 to 5 35	5 25 to 5 50	6 25 to 6 50	6 25 to 6 35	6 00 to 6 25
superfine	4 25 to 4 50	5 00 to 5 25	5 35 to 5 65	5 50 to 5 75	5 35 to 5 60
low grades	3 75 to 4 00	4 50 to 5 00	4 50 to 5 00	5 00 to 5 40	5 00 to 5 30
Wheat, No. 1 white	1 20 to 1 35	1 40 to 1 43	1 45	1 45 to 1 50	
No. 2 white					
No. 1 red	1 16 to 1 17	1 32 to 1 33	1 37 to 1 38	1 38 to 1 40	1 36 to 1 37
No. 2 red	1 14 to 1 15	1 30	1 35	1 35 to 1 38	1 33 to 34
Corn, No. 1	53 to 54	52 to 53	57	59	57 to 58
new ear	53 to 54	53	56	57	7
Rye, No. 1	83	1 05	1 05	1 13 to 1 15	1 00 to 1 02

PRODUCTS FOR 1871.

the markets at the beginning of each month.

June.	July.	August.	September.	October.	November.	December.
$5 60 to $6 80	$5 40 to $5 65	$4 50 to $6 25	$4 95 to $6 40	$6 20 to $7 50	$6 00 to $7 30	$5 80 to $7 10
5 60 to 9 00	5 40 to 9 00	4 50 to 9 00	4 95 to 9 00	6 20 to 9 25	6 00 to 9 25	5 80 to 9 25
1 46 to 1 51	1 44 to 1 51	1 32 to 1 37½	1 30 to 1 35	1 57 to 1 61	1 48 to 1 53	1 50 to 1 55
1 68 to 1 69	1 55 to 1 57	1 38 to 1 45	1 37 to 1 44	1 65 to 1 75	1 55 to 1 65	1 58 to 1 64
70 to 75	71½ to 72	65 to 67½	65 to 68	75 to 78	77 to 79	76 to 80
Nominal.	Nominal.	Nominal.	Nominal.	93........	Nominal.	90........
Nominal.	Nominal.	Nominal.	80........	....	73 to 1 13	90 to 1 30
64½ to 67	71½ to 72	51 to 61	40 to 48	52 to 54	50 to 52	54 to 57
19 00 to 20 00	21 00........	25 00........	20 00........	22 00 to 23 00	22 00........	23 00 to 24 00
22 00 to 26 00	24 00 to 29 00	26 00 to 32 00	23 00 to 27 00	25 00 to 33 00	24 00 to 31 00	25 00 to 33 00
15 50 to 15 95	15 50 to 15 75	13 87 to 14 00	13 50 to 13 75	13 45 to 13 62	12 85 to 13 00	13 45 to 13 50
13 00 to 13 25	13 00 to 13 25	12 00 to 12 50	11 00........	11 00 to 11 25	11 00........	11 00........
10 00 to 15 00	8 00 to 12 00	8 00 to 12 00	7 00 to 11 00	7 00 to 11 00	7 00 to 11 00	7 00 to 11 00
13 00 to 16 00	13 00 to 16 00	13 00 to 15 00	11 00 to 14 00	11 00 to 14 00	11 00 to 14 00	11 00 to 14 00
9½ to 10½	9¾ to 11	9½ to 10⅜	9½ to 9¾	9½ to 10½	9½ to 10¼	9 to 9¾
11 to 20	11 to 23	11 to 20	11 to 20	10 to 20	12 to 23	12 to 23
15 to 24	15 to 31	15 to 30	15 to 31	15 to 30	15 to 32	21 to 33
5 to 12	5 to 12	5 to 10	5 to 10	11 to 12½	11 to 12½	11 to 12½
8 to 13½	8 to 12¼	8 to 11	8 to 10¾	12 to 13½	12 to 13¾	12 to 14
13½ to 16¼	15⅝ to 18⅜	15⅛ to 17½	15¾ to 17⅜	17¼ to 19	16¾ to 18½	16¼ to 18⅛
17 to 19½	19⅞ to 22⅜	18½ to 21⅝	18⅜ to 21¾	19⅜ to 21¾	18¾ to 20¾	18⅝ to 20⅞
5¼ to 6½	5¾ to 7¼	6¾ to 8	7¼ to 8¼	7½ to 8¼	7¼ to 8¼	7½ to 8¼
6¼ to 7¾	7 to 8½	8 to 9¼	8¼ to 10	8¼ to 10	8¼ to 10	8¼ to 10
54........	60 to 61	60 to 62	61 to 62½	60 to 62½	60 to 63	63 to 66
....	62½ to 65	62½ to 63	61½ to 65	63 to	63........	66........
48 to 50	38½ to 57½	45 to 60	42½ to 65	62 to 63	60........	43 to 63
37½ to 38½	30 to 42	....	....	32 to 47	....	....
37½ to 38½	39 to 40	38 to 42½	37 to 45½	37½ to 40	37½........	34 to 38
5 75 to 6 00	5 00 to 5 25	4 75 to 5 00	4 75 to 5 00	6 00 to 6 25	5 75 to 6 50	5 50 to 5 75
6 50 to 8 00	6 00 to 8 00	5 50 to 7 00	5 50 to 6 75	6 25 to 8 00	7 25 to 8 25	6 00 to 8 25
8 25 to 10 50	7 00 to 10 50	7 00 to 9 00	7 00 to 9 00	7 50 to 10 00	7 50 to 10 25	7 50 to 10 25
1 55 to 1 85	1 55 to 1 85	1 35 to 1 60	1 25 to 1 60	1 55 to 1 80	1 60 to 1 65	1 60 to 1 65
80 to 82	81 to 82	77 to 78	77 to 79	86 to 88	88 to 90	80 to 87
76 to 79	79 to 81	74 to 76	75 to 77	84 to 86	86 to 88	82 to 85
68 to 71	65 to 70	60 to 65	47 to 55	50 to 58	50 to 57	51 to 57
1 18 to 1 25	1 10 to 1 20	95 to 1 00	75 to 80	95 to 1 00	95 to 1 00	95 to 1 00
95 to 1 10	90 to 1 20	95 to 1 10	90 to 1 10	95 to 1 00	95 to 1 12	75 to 95
20 00 to 32 00	22 00 to 33 00	20 00 to 32 00	25 00 to 37 00	20 00 to 33 00	20 00 to 32 00	20 00 to 33 00
17 50 to 18 00	16 00 to 16 50	15 50 to 16 00	14 50 to 15 00	14 50 to 14 75	14 25 to 14 50	13 50 to 15 00
14 50 to 15 00	13 50 to 14 50	13 00 to 14 00	12 00 to 12 50	11 50 to 12 00	11 00 to 12 00	11 00 to 12 50
12 00 to 14 00	12 00 to 14 00	12 00 to 14 00	12 00 to 14 00	10 00 to 12 00	10 00 to 12 00	10 00 to 12 00
15 00 to 20 00	15 00 to 20 00	15 00 to 20 00	15 00 to 19 00	12 50 to 16 00	13 00 to 16 00	12 00 to 16 00
11 to 11½	11 to 11½	10½ to 11¼	9¼ to 10½	10 to 10½	10¼ to 10¾	9¾ to 10
18 to 26	18 to 27	15 to 28	12 to 28	20 to 32	18 to 33	18 to 33
18 to 25	20 to 26	18 to 26	18 to 27	18 to 29	20 to 30	20 to 30
15 to 24	15 to 23	15 to 24	18 to 26	15 to 25	14 to 25	12 to 28
10 to 15	10 to 12½	9 to 10½	9 to 11½	11½ to 14	12 to 14	12 to 14½
13 to 14	8 to 12	9½ to 10	9½ to 10	12 to 13	12 to 13	12½ to 13½
50 to 72½	55 to 75	60 to 75	58 to 75	58 to 75	58 to 75	58 to 70
52 to 56	55 to 62	58 to 65	58 to 63	57 to 62	56 to 65	56 to 65
48 to 55	53 to 60	58 to 63	55 to 62	55 to 60	55 to 62	55 to 62
24 to 25	24 to 25	30 to 52	35 to 53	35 to 55	35 to 55	35 to 55
25 to 40	25 to 40	30 to 46	30 to 47½	30 to 47½	30 to 47½	30 to 47½
57 to 60	63 to 70	65 to 70	67 to 72	68 to 75	68 to 75	68 to 72
35 to 60	35 to 60	40 to 65	50 to 68	40 to 72½	40 to 75	40 to 75
6 60 to 6 75	6 35 to 6 60	5 50 to 5 65	5 50 to 5 75	7 00 to 7 25	6 75 to 6 90	6 60 to 6 90
6 60 to 6 75	6 15 to 6 25	5 25 to 5 40	5 25 to 5 50	6 85 to 7 00	6 30 to 6 50	6 50 to 6 60
6 00 to 6 15	5 25 to 5 50	4 75 to 4 90	4 25 to 4 75	5 75 to 6 25	5 75 to 5 90	5 75 to 6 00
5 50 to 5 80	4 00 to 4 50	4 00 to 4 50	4 00 to 4 50	4 50 to 5 25	4 50 to 5 00	4 50 to 5 25
1 50 to 1 55	....	1 25........	1 25........	1 55 to 1 60	1 55 to 1 60	1 55 to 1 60
1 45 to 1 50	....	1 22........	1 22........	1 50 to 1 60	1 50 to 1 55	1 50 to 1 55
1 48 to 1 46	1 35 to 1 38	1 12 to 1 13	1 19........	1 50........	1 41 to 1 43	1 43 to 1 45
....	....	1 10........	1 17........	1 48........	1 40........	1 40 to 1 42
55........	59........	51 to 52	54........	53 to 54	56........	47........
53........	55 to 56	....	52........	54........	53 to 54	....
1 05........	98 to 1 00	65........	68........	82........	78........	79 to 80

MARKET PRICES OF FARM

The following quotations represent the state of

Products.	*January.	February.	March.	April.	May.
CINCINNATI—Continued.					
Rye, No. 2	$0 81	$1 00	$1 00	$1 10 to $1 12	$0 98 to $1 00
Barley, No. 1	95 to $1 00	1 00 to $1 03	1 00	90 to 95	1 10 to 1 12
No. 1, State				80	
Oats, No. 1, mixed	42 to 43	48 to 50	50 to $0 52	53 to 54	54 to 55
No. 2, mixed	40 to 42	46 to 48	48 to 50	50 to 52	52 to 54
Hay, tight-pressed	17 00 to 20 00	18 00 to 21 00	16 00 to 19 00	16 00 to 19 00	17 00 to 21 00
loose-pressed	19 00 to 23 00	19 00 to 23 00	18 00 to 23 00	18 00 to 21 00	18 00 to 25 00
Pork, mess	19 00	21 75 to 22 50	21 25 to 22 00	21 00	18 00 to 18 25
Lard, prime, steam	10⅝ to 10¾	12⅛ to 12¼	12¼	11¼ to 11⅝	
Butter, choice Ohio	26 to 28	24 to 30	26 to 28	26 to 32	20 to 28
fair to good		18 to 21	20 to 22	20 to 22	17 to 20
Cheese, Western Reserve.	13½ to 14½	13½ to 14½	13½ to 14½	13 to 14	13½ to 14
factory	14½ to 15½	14½ to 15½	14½ to 16	15 to 16½	15 to 15½
Cotton, ordinary	12	10½ to 13¼	9 to 13	9 to 12¼	6 to 12¼
middling	14 to 14¼	14 to 14½	13½ to 14⅜	13 to 14½	13 to 14¾
Tobacco, lugs, W. Va	6½ to 8	4 to 8	4 to 12	5½ to 8	5½ to 7½
Kentucky	7 to 10	7 to 10	7 to 15	7 to 10	6¾ to 10
com. to medium leaf, W. Va	8 to 12	8 to 9	8 to 12	8 to 20	7½ to 10
com. to medium leaf, Kentucky	10 to 18	10 to 15	10 to 15	10 to 14	12 to 14
Wool, tub-washed	45 to 48	48 to 50	48 to 50	48 to 50	48 to 50
fleece-washed	40 to 45	42 to 44	42 to 44	42 to 44	42 to 47
unwashed	30 to 35	30 to 31	30 to 36	30 to 36	28 to 36
pulled	31 to 32	36 to 38	36 to 38	36 to 38	38 to 40
CHICAGO.					
Flour, winter, extras	5 00 to 7 50	5 50 to 8 00	5 50 to 8 00	7 75	6 50 to 8 50
spring, extras	4 25 to 6 00	5 25 to 7 00	5 25 to 7 00	5 75 to 6 25	5 50 to 7 00
Wheat, No. 1 spring	1 08¼ to 1 11	1 29½ to 1 30	1 25 to 1 25½	1 29½ to 1 30	1 27½ to 1 29½
No. 2 spring	1 07⅝ to 1 08¼	1 28 to 1 30	1 23¼ to 1 24½	1 23½ to 1 29½	1 26¼ to 1 26½
No. 3 spring	1 01 to 1 02½	1 18 to 1 20	1 17½ to 1 18½	1 21¼ to 1 22½	1 13 to 1 23
Corn, No. 2	53 to 53½	52¼ to 52½	50 to 51	51⅝ to 51½	55¼ to 55½
rejected			47½ to 48	53 to 53¼	53¼ to 54½
Rye, No. 1	73 to 74	88	90	93	88
No. 2	72 to 74	85 to 86	88½ to 89	91 to 93	83
rejected	65 to 66			82 to 84	80
Barley, No. 2	68 to 70	84 to 84½	83	81½ to 82	82 to 83
No. 3	55	70 to 73	60 to 70	60 to 65	55 to 65
rejected	40		40 to 43	40 to 45	40 to 45
Oats, No. 2	38¼ to 39¾	46½	48¼ to 49¼	47½ to 50	46¼ to 49½
rejected	36½ to 37	44½	47	47½ to 48	44½ to 45
Hay, timothy, and clover, (on track)	15 00 to 18 00	16 00 to 17 50	15 00 to 16 00	15 00 to 16 00	14 00 to 14 50
prairie	9 50 to 15 00	12 00 to 15 00	11 00 to 16 00	10 00 to 15 00	9 00 to 13 50
Pork, mess	18 00 to 18 25	22 37½ to 22 62½	21 25 to 21 37½	20 15 to 20 50	17 50 to 18 00
prime	17 50 to 17 75	20 50 to 21 00	19 00 to 19 25	18 00	15 50
Beef, mess	11 00	11 00 to 11 50	13 00 to 13 50	12 50 to 13 00	12 50 to 13 00
extra mess	13 00	13 00 to 13 50	14 00 to 14 50	14 50 to 15 00	14 00 to 14 50
Lard	10⅛ to 11¼	12⅜ to 12½	12½	11⅝ to 11⅞	11 to 11¼
Butter, fair to good	20 to 25	20 to 24	18 to 22	18 to 22	18 to 20
choice	27 to 30	26 to 28	25 to 27	25 to 28	24 to 26
Cheese, New York factory	15 to 16½	15½ to 16	17 to 18	18 to 19	18 to 19
western factory	12 to 14½	12 to 14	15 to 16	15 to 16	15 to 16
Wool, medium fleece	35 to 43	35 to 43	35 to 45	38 to 48	38 to 47
unwashed	25 to 30	25 to 30	26 to 30	33 to 35	33 to 35
tub	42 to 48	45 to 50	45 to 50	45 to 50	45 to 50
SAINT LOUIS.					
Flour, superfine	4 20 to 4 60	5 00 to 5 50	5 00 to 5 95	5 25 to 5 75	5 00 to 5 40
extra	4 65 to 6 25	5 80 to 6 40	6 00 to 6 75	6 00 to 6 75	5 50 to 6 75
choice	6 50 to 8 50	6 75 to 8 50	6 75 to 8 50	7 00 to 8 50	7 15 to 7 75
Wheat, spring	1 05 to 1 15	1 15 to 1 25	1 18 to 1 35	1 00 to 1 35	1 10 to 1 35
winter white	1 25 to 1 50	1 36 to 1 55	1 35 to 1 75	1 30 to 1 65	1 60 to 1 65
winter red	1 06 to 1 35	1 30 to 1 50	1 30 to 1 65	1 32 to 1 60	1 32 to 1 55
Corn, mixed	44 to 46½	47 to 60	48 to 59	50 to 57½	47½ to 58
yellow	46 to 47	54 to 65	58 to 60	51½ to 53½	57½ to 58
Rye	75 to 80	95 to 96	95 to 1 02	95 to 99	75 to 91
Barley, winter	65 to 85	70 to 1 00	95 to 1 10	98 to 1 65	85 to 90
spring	40 to 70	60 to 95	85 to 1 00	98 to 1 25	70 to 1 20
Oats, mixed	40 to 46	48 to 59	48½ to 60	50 to 54	49 to 56½
white	46 to	58 to 60		55 to 56½	46 to 58
Hay	16 00 to 18 50	18 00 to 19 00	21 00	18 00 to 22 00	15 00 to 19 00
Pork, mess	19 00 to 19 50	22 50 to 22 75	21 75 to 22 00	20 00 to 20 50	18 25 to 18 50

PRODUCTS FOR 1871.

the market at the beginning of each month.

June.	July.	August.	September.	October.	November.	December.
$1 00........	$0 93 to $0 95	$0 63........	$0 65	$0 80	$0 76	$0 77 to $0 78
1 05 to $1 08	....	....	....	95	80	88 to 90
95 to 1 00	....	65 to $0 70	70	90	70	75 to 80
54 to 55	55 to 57	35 to 37	34 to $0 35	34 to $0 36	34 to $0 36	37 to 38
52 to 54	....	33 to 35	30 to 33	35	35	36 ....
15 00 to 21 00	17 00 to 23 00	16 00 to 18 00	15 00 to 18 00	16 00 to 17 00	16 00 to 17 00	15 00 to 19 00
18 00 to 25 00	19 00 to 30 00	18 00 to 27 00	16 00 to 22 00	17 00 to 24 00	17 00 to 18 00	17 00 to 21 00
16 00........	15 00 to 15 25	12 50 to 13 00	12 25 to 12 75	12 50 to 13 00	12 00 to 12 50	12 50 to 13 50
....	11........	9¼........	8¼	9¼ to 12¾	8¾ to 8⅞	8⅜ to 8½
17 to 22	18 to 20	17 to 22	18 to 22	18 to 22	16 to 22	23 to 25
13 to 14	14 to 15	12 to 15	12 to 14	10 to 14	....	16 to 18
10 to 11	9 to 10	....	....	....	13 to 13½	....
12 to 12½	10 to 11	9½........	9 to 9½	14 to 14½	14 to 14½	14 to 15
11½ to 14½	13¾ to 18¼	13¼ to 17½	13¼ to 16½	16 to 16½	14½ to 16½	14 to 17⅜
15½ to 18	19½ to 21¼	18 to 20¼	17 to 19	19¼ to 19½	17 to 18¾	17¾ to 19¼
4½ to 7½	4½ to 6½	4½ to 8½	4½ to 7½	....	....	5 to 6
7 to 12	7½ to 8½	8¼ to 12	8¼ to 12	9 to 12½	9¼ to 13	9¼ to 11
7½ to 10	7½ to 10	7½ to 10	7 to 10	....	....	8 to 9
10½ to 15	10 to 16	12 to 18	12 to 18	13 to 18	13 to 16	13 to 16
43 to 48	55 to 58	65 to 67	65 to 67	65 to 67	65 to 70	65 to 70
38 to 50	48 to 55	50 to 55	50 to 55	50 to 55	50 to 55	42 to 55
28 to 38	34 to 40	40 to 45	40 to 42	40 to 45	42 to 45	42 to 45
38 to 40	45 to 47	50 to 52	50 to 52	50 to 52	50 to 52	50 to 52
6 50 to 8 50	6 75 to 8 50	5 90 to 6 25	6 00 to 6 87½	7 00 to 7 75	7 50 to 8 00	8 00........
5 25 to 7 00	5 25 to 7 00	4 50 to 6 00	4 00 to 6 25	5 62½ to 6 75	6 00 to 7 37½	6 00 to 7 00
1 28 to 1 29	1 24½ to 1 26	1 03 to 1 04	1 07 to 1 07½	....	1 21½........	1 23½........
1 26 to 1 27	1 24 to 1 25½	1 00½ to 1 00¾	1 06½........	1 21½ to 1 25	1 18½ to 1 19½	1 18 to 1 19½
1 11 to 1 21	1 17 to 1 18	92 to 93	1 00 to 1 02	1 18¾ to 1 19¼	1 12½ to 1 13	1 09........
51¾ to 52⅛	53 to 53⅜	41 to 42½	43½ to 44½	46 to 47½	46 to 49	40½ to 41½
49¾ to 51	51 to 51¼	40 to 40½	40½ to 43	45........	46........	38¾ to 40
84........	....	....	....	64¾ to 65¼	....	....
83 to 83½	88........	51 to 52½	56½........	64¾ to 65¼	60½........	61¼ to 61½
....	....	....	52........	56........	51........	....
65 to 70	73 to 75	64½ to 75	62¾ to 80	60½ to 79	55¼ to 56	60 to 61
55 to 60	55 to 60	55........	50 to 52	50 to 53	40 to 44½	50 to 51
50........	45........	49........	45 to 47	....	36½ to 40	....
48 to 49	46 to 48	25 to 35	29½ to 29¾	30 to 30⅝	29¾ to 30½	31¾ to 32
45½ to 46	44........	....	26 to 26¼	27½ to 28	26½ to 27	29 to 29½
14 00 to 15 00	14 00 to 15 00	13 00 to 14 00	13 00 to 14 00	13 50 to 14 50	13 00 to 14 00	14 00 to 15 00
10 00 to 14 50	10 00 to 13 00	9 00 to 12 00	8 00 to 12 00	8 00 to 10 00	8 00 to 10 00	9 00 to 13 50
14 50 to 15 25	15 00 to 15 25	13 00 to 13 25	12 37½ to 12 50	13 00 to 13 12½	12 00........	13 00 to 13 05
12 25 to 12 50	12 00 to 13 50	....	....	....	....	....
12 00 to 12 50	11 00 to 13 00	12 00 to 12 50	9 90 to 12 00	12 00........	8 25........	8 25 to 8 50
14 00 to 14 50	14 00 to 14 50	14 00 to 14 50	11 00 to 12 00	13 50........	9 25........	10 00........
10 to 10½	10⅛........	9⅛ to 9⅝	8⅜ to 8⅝	9¼........	8¾........	8⅝ to 8⅞
15 to 16	15 to 16	15 to 17	16 to 19	17 to 21	15 to 20	14 to 18
17 to 20	17 to 20	19 to 20	21 to 23	23 to 25	22 to 25	23 to 25
14 to 15	11 to 12	10 to 11	9½ to 10	13 to 14	15 to 15½	15 to 15½
12 to 13	9 to 10	9 to 10	7½ to 8½	11½ to 12½	12 to 14	13 to 14
40 to 47	45 to 54	50 to 59	55 to 61	55 to 61	55 to 61	55 to 62
20 to 33	25 to 43	35 to 44	35 to 44	35 to 44	35 to 38	35 to 44
40 to 54	48 to 64	55 to 70	60 to 72	60 to 73	60 to 78	61 to 75
5 25........	4 75 to 5 00	4 25 to 4 50	4 00 to	4 80 to 5 20	5 00 to 5 25	5 10........
5 65 to 6 70	5 25 to 6 75	4 75 to 6 25	4 80 to 5 50	5 25 to 6 50	5 50 to 6 50	5 75 to [illegible]
7 25 to 8 00	7 00 to 7 90	6 50 to 7 00	5 90 to 8 75	5 75 to 9 00	7 00 to 8 00	7 50 to 00
1 10 to 1 25	....	....	....	1 15 to 1 18	1 22........	1 25 to 1 33
1 35 to 1 50	1 15 to 1 30	1 05 to 1 35	1 04 to 1 40	1 45 to 1 75	1 26 to 1 80	1 25 to 1 33
1 25 to 1 58	1 10 to 1 30	95 to 1 32	1 04 to 1 37	1 15 to 1 60	1 28 to 1 65	1 33 to 1 57
48½ to 60	50 to 60	40 to 51½	42 to 49	46 to 52	42 to 46	44 to 55
49 to 58	52 to 61	47 to 55	52........	51 to 52	43 to 51½	45 to 46
75 to 86	83 to 87½	51½ to 58	58½ to 95	67 to 73	57 to 66	70 to 74
88 to 1 00	70 to 81	60 to 78	65 to 95	65 to 90	45 to 80	75........
55 to 1 00	35........	60........	60 to 1 00	70 to 90	....	54 to 75
48 to 56¼	50 to 57	31½ to 38	33½ to 40	34½ to 40	30 to 38½	36 to 39
53 to 57	56 to 62	34 to 38	40 to 43	39 to 40	38 to 39	38 to 44
13 00 to 17 00	15 00 to 24 00	17 50 to 20 00	16 00 to 24 00	15 00 to 25 00	20 00 to 21 00	22 00 to 26 50
16 00........	13 50 to 16 00	13 50 to 14 25	13 00........	13 00 to 13 25	12 75 to 13 00	13 00........

MARKET PRICES OF FARM

The following quotations represent the state of

	January.	February.	March.	April.	May.
SAINT LOUIS—Continued.					
Lard, tierce	$0 10 to $0 12	$0 12½ to $0 13¾	$0 12	$0 11¾ to $0 12	$0 09½ to $0 11¼
keg	13 to 13½	13¾ to 14	12	12¾ to 13	12¼ to 13¼
Butter, choice	30 to 32	27 to 29	28 to $0 30	28 to 30	27 to 29
fair to good	20 to 25	15 to 20	15 to 25	15 to 22	15 to 22
Cheese	15½ to 16½	15½ to 24	15 to 24	15½ to 23	17 to 27
Cotton, middling	13½ to 14	13 to 14½	11½ to 14	13⅜ to 14	13½ to 14½
Tobacco, sound lugs	5 00 to 6 25	5 00 to 6 50	3 75 to 6 00	3 80 to 6 00	3 50 to 5 50
common leaf	7 50 to 8 50	7 50 to 8 50	5 50 to 7 50	6 25 to 7 50	5 50 to 6 50
medium leaf	8 75 to 9 50	8 75 to 9 50	7 50 to 8 50	7 50 to 8 75	6 50 to 7 50
Wool, tub-washed	40 to 48	40 to 48	42 to 51	42 to 51	48 to 53
fleece-washed	31 to 41	31 to 41	32 to 43	33 to 43	32 to 38
combing	35 to 36	35 to 36	38 to 40	38 to 40	33 to 38
pulled	30 to 33	30 to 33	32 to 36	33 to 36	
NEW ORLEANS.					
Flour, superfine	5 50 to 5 75	6 25 to 6 37½	6 62½ to 6 75	6 75	5 65 to 6 00
extra	5 80 to 8 00	6 25 to 9 00	7 00 to 9 00	6 87½ to 8 00	6 25 to 8 75
Corn, mixed	69	70 to 72	71	70	70 to 71
yellow	69 to 70	70 to 72	71 to 72	70	71 to 72
white	69 to 70	72 to 75	73	65 to 68	72 to 76
Oats, choice	54 to 56	70	73	65 to 68	64 to 65
Hay, choice	30 00 to 32 00	28 00	26 00 to 28 50	25 00 to 26 00	23 00 to 24 00
prime	32 00	26 00 to 27 00	24 00 to 26 00	23 00 to 24 00	20 00 to 22 00
Pork, mess	21 00 to 21 50	23 50 to 24 50	23 50 to 24 25	21 00 to 23 00	19 00 to 19 50
Lard, tierce	12¼ to 12¾	12½ to 13¼	12½ to 13	12 to 12½	11 to 11½
keg	13¾ to 14½	14¼ to 14½	14 to 14½	12½ to 12¾	12½ to 12¾
Butter, choice western	30 to 32	25 to 31	25 to 28	25 to 28	25
choice northern	42 to 44	40 to 42	40 to 43	43 to 44	42 to 43
common northern	30 to 35	25 to 30	25 to 30	25 to 30	
Cheese, choice factory	15½ to 16½	16 to 16½	15 to 15½	15 to 15½	16 to 17½
Western Reserve	14 to 14¼	14½ to 15	13½	13 to 13½	14
Cotton, ordinary	12 to 12½	12 to 12½	12¼ to 12¾	8½ to 13⅝	10½ to 11
low middling	13⅞ to 14⅞	14 to 14½	13¼ to 13¾		13½ to 14
middling	14⅜ to 14⅝	14⅞ to 15	14¼ to 14½	14½ to 15½	14½ to 15½
Tobacco, lugs	5½ to 7	6 to 7	5½ to 7	5½ to 7	5½ to 7
low leaf	6¾ to 8	7 to 7½	7 to 7½	7 to 7½	7 to 7½
medium leaf	7½ to 8½	7½ to 8	8 to 9	7½ to 8	7½ to 8¼
SAN FRANCISCO.					
Flour, State	5 25 to 6 50	5 50 to 7 00	5 50 to 7 00	5 75 to 7 25	7 00 to 8 00
Oregon	5 25 to 6 50	5 50 to 7 00	5 50 to 7 00	5 50 to 7 25	7 00 to 8 00
Wheat, State	2 00 to 2 30	2 15 to 2 52½	2 25 to 2 40	2 30 to 2 50	2 85 to 3 00
Oregon	2 25 to 2 30	2 15 to 2 52½	2 30 to 2 40	2 40 to 2 50	2 90 to 3 00
Corn, white	1 50 to 1 60	1 40 to 1 55	1 50	1 60 to 1 70	2 70 to 2 75
yellow	1 50 to 1 60	1 40 to 1 55	1 50	1 60 to 1 70	2 70 to 2 75
Barley	1 35 to 1 45	1 35 to 1 45	1 25 to 1 40	1 45 to 1 50	2 15 to 2 50
Oats	1 40 to 1 60	1 45 to 1 75	1 50 to 1 70	1 55 to 1 70	2 00 to 2 50
Hay, State	12 00 to 16 00	12 00 to 16 00	14 00 to 15 50	12 00 to 14 50	18 00 to 23 50
Pork, mess	24 00 to 26 00	24 00 to 26 00	24 00 to 26 00	25 00 to 29 00	25 00 to 27 00
prime	21 00 to 22 50	21 00 to 22 50	21 00 to 22 00	21 00 to 22 00	25 00
Beef, mess	18 00 to 24 00	16 00 to 24 00	16 00 to 24 00	16 00 to 24 00	16 00 to 24 00
Lard in barrels	12½ to 13	12½ to 13	14 to 15	14½ to 15	14
domestic	11 to 12	12 to 13	14 to 14½	14 to 14½	14
Butter, State	40 to 55	40 to 45	30 to 35	25 to 30	25 to 32½
Oregon	12 to 17	15	15	15	15
overland	25 to 35	25 to 35	25 to 30	20 to 25	20 to 25
Cheese	12 to 17	9 to 14	9 to 14	9 to 14	9 to 14
Wool, native	13 to 14	13 to 14	16 to 18	16 to 18	22½ to 27½
California	15 to 18½	15 to 18½	25 to 26	25	30 to 32½
Oregon	24 to 25	24 to 25	25 to 27½	25 to 26	30 to 32½

PRODUCTS FOR 1871.

the market at the beginning of each month.

June.	July.	August.	September.	October.	November.	December.
$0 09 to $0 10½	$0 09 to $0 10½	$0 10 to $0 10½	$0 09½ to $0 09¾	$0 09¼ to $0 10¼	$0 09¼ to $0 09½	$0 08½ ....
10½ to 11¾	11½ to 11¾	11	11	10¾ to 16	10½ to 10¾	....
18 to 20	18 to 20	18 to 20	18 to 21	22 to 26	26 to 27	23 to $0 28
12 to 16	12 to 16	14 to 15	14 to 16	18 to 20	17 to 20	17 to 25
14½ to 16	12 to 20	10½ to 12	9½ to 10	13½ to 14½	14 to 15½	14½ to 15
15½ to 16	17½ to 19½	19 to 19½	18 to 18½	17½ to 18½	17 to 17½	17½ ....
3 50 to 5 75	5 75 to 7 50	5 50 to 7 50	6 50 to 7 75	7 00	7 00 to 8 50	6 75 to 8 00
5 75 to 6 75	7 75 to 8 00	7 75 to 8 00	7 00 to 8 00	.... to 8 75	8 00 to 9 00	8 00 to 8 75
6 75 to 7 75	8 00 to 9 00	8 00 to 9 00	8 50	8 75 to 9 00	9 00 to 12 00	9 00 to 12 00
50 to 58	57 to 64	60 to 69	60 to 68½	60 to 69	60 to 70	60 to 68
38 to 58	45 to 55	48 to 56	48 to 56	48 to 56	48 to 56	48 to 56
27 to 41	41 to 43	42 to 43½	42 to 43½	43 to 44	42 to 43½	42 to 43½
43 to 45	43 to 45	....	....	....	....	....
6 12½ to 6 25	5 00 to 5 25	5 25	4 50	5 00 to 5 75	6 00	....
6 50 to 10 50	5 75 to 9 75	6 25 to 9 25	5 25 to 8 00	6 50 to 8 50	6 75 to 8 50	7 30 to 9 00
70 to 76	70 to 75	72½ to 73	67 to 68	82½ to 84	88 to 90	75 to 78
75	71 to 72	74	70	82½ to 85	82½	73 to 77
76 to 78	74 to 75	77 to 78	70	82½ to 85	93 to 94	78 ....
65	63 to 65	64 to 66	49 to 50	57	52½ to 53	53 to 55
24 00 to 25 00	27 00 to 28 00	32 00	32 00 to 35 00	34 00	34 00 to 35 00	40 00 to 42 00
23 00 to 24 00	25 00 to 26 00	30 00	....	36 00 to 38 00	33 00	40 00 ....
16 50 to 17 50	16 12½ to 16 75	14 50 to 15 75	14 00 to 15 00	14 25 to 15 00	15 25 to 15 75	14 50 to 15 00
11 to 11½	10⅛ to 11	10¾ to 11	10¼ to 10½	....	10½	8¾ to 10¾
12 to 12½	11⅛ to 11¾	11⅓ to 11¾	11¼ to 11½	....	12	10 to 10¾
22 to 26	20 to 23	20 to 23	21 to 22	20	22 to 24	22 to 25
34 to 35	32 to 35	32 to 34	30 to 34	33 to 34	32 to 33	33 to 34
....	....	....	....	20 to 25	....	....
15 to 16	12½ to 13	12 to 13	10 to 12½	13 to 14	14 to 16	14 to 15
13 to 14	11 to 12	11	....	12½	12½	12½ ....
12 to 13	13¾ to 18½	13 to 17	16¼ to 17	15 to 16	17⅛ to 17¾	16 to 17⅞
15 to 15½	20 to 20½	18 to 18½	18¼ to 18¾	18⅞ to 19¼	17½ to 18	18 to 18⅛
16 to 16½	21	20 to 20½	18¼ to 18¼	18¼ to 20½	18⅛ to 18½	18½ to 18⅞
5½ to 6¾	6 to 7	6 to 7	6¼ to 6¾	....	7 to 8	7 to 8
6¾ to 7½	7 to 7¼	7 to 7½	....	....	8 to 8½	8 to 8½
7¼ to 8	7½ to 8	7½ to 8	8	....	9	9 to 9½
6 75 to 8 00	6 25 to 7 25	6 00 to 6 75	6 00 to 7 00	6 75 to 7 50	6 75 to 7 75	6 25 to 7 50
6 75 to 8 00	6 25 to 7 25	6 00 to 6 75	6 25 to 7 00	6 75 to 7 50	6 75 to 7 75	6 25 to 7 50
2 45 to 2 65	2 30 to 2 40	2 20 to 2 25	2 30 to 2 40½	2 50 to 2 70	2 50 to 2 65	2 40 to 2 60
2 55 to 2 60	2 40	2 25 to 3 00	2 35 to 2 40	2 60 to 2 70	2 50 to 2 65	2 40 to 2 60
2 25 to 2 35	2 00 to 2 25	2 15 to 2 25	2 40	2 35	2 00 to 2 05	2 10 to 2 15
2 25 to 2 35	2 00 to 2 25	2 15 to 2 20	2 40	2 35	2 00 to 2 05	2 15 to 2 20
1 85 to 1 90	1 95 to 2 00	1 55 to 1 90	1 80 to 2 00	2 00 to 2 15	1 87 to 2 05	1 85 to 2 05
1 87 to 2 25	1 75 to 1 90	1 80 to 1 90	1 80 to 1 90	1 90 to 2 00	1 60 to 1 85	1 85 to 2 00
14 00 to 20 00	15 00 to 21 00	17 00 to 20 00	17 00 to 22 00	18 00 to 22 50	18 00 to 22 50	18 00 to 23 00
25 00 to 27 00	25 00 to 27 00	25 00 to 26 00	22 00 to 26 00	20 00 to 24 00	19 00 to 22 00	19 00 to 22 00
22 50	22 50	22 00	19 00 to 19 50	19 00 to 19 50	18 00 to 18 50	18 00 to 18 50
14 00 to 24 80	14 00 to 24 00	14 00 to 24 00	14 00 to 24 00	14 00 to 24 00	14 00 to 24 00	13 00 to 22 00
13¾ to 14	12 to 12½	12½ to 13	12	11½ to 11¾	12	11½ to 11¾
14 to 14½	13 to 14	13 to 14	12½ to 13	12½ to 13	12½ to 13	12½ to 13
25 to 32½	25 to 31	25 to 30	28 to 34	30 to 45	35 to 50	35 to 50
15 to 20	15 to 20	15 to 20	15 to 20	15 to 20	20 to 25	20 to 25
25 to 30	25 to 28	25 to 28	20 to 27½	18 to 25	20 to 35	20 to 35
9 to 14	9 to 14	9 to 14	9 to 14	9 to 14	12½ to 17	15 to 17
20 to 25	25 to 27½	25 to 27½	26 to 28	15 to 20	18 to 20	18 to 20
30 to 35	30 to 35½	30 to 35	30 to 35	25 to 30	25 to 32	25 to 32
30 to 33	38 to 42½	40 to 02	40 to 42½	32½ to 35	32½ to 35	32½ to 35

LIVE STOCK MARKETS.

NEW YORK.

The live stock trade of New York during 1871 exhibits a general decline of prices, entailing loss upon contractors, who had generally calculated upon a continuance of former rates, or even an advance. The same general feature rendered the operations of the year unsatisfactory to feeders in the West. The arrivals of all farm animals during four years, ending with 1871, were as follows:

Stock.	1868.	1869.	1870.	1871.
Beeves	293, 101	325, 761	356, 026	380, 934
Cows	5, 382	4, 836	5, 050	4, 646
Calves	82, 935	93, 984	116, 457	121, 937
Sheep	1, 400, 623	1, 479, 563	1, 463, 878	1, 331, 975
Hogs	976, 511	901, 308	889, 625	1, 334, 492
Total	2, 758, 552	2, 805, 452	2, 831, 036	3, 273, 984

An increase is noted in beeves, calves, and hogs—in the latter quite marked—while in cows and sheep a considerable decline is presented. The weekly receipts of cattle averaged 7,187; of cows, 88; of calves, 2,301; of sheep, 25,132; of hogs, 25,179; of all kinds, 59,887.

The sources of cattle supply were as follows: Illinois, 242,161; Kentucky, 34,879; Ohio, 28,801; Texas, 27,737; New York, 13,898; Indiana, 13,566; Missouri, 7,833; Virginia, 4,474; Iowa, 2,546; Canada, 1,638; Michigan, 1,337; Kansas, 1,133; Pennsylvania, 395; Connecticut, 222; New Jersey, 136; Massachusetts, 93; Wisconsin, 72; England, 23. Illinois increased her supply, over last year, 36,806; Kentucky, Ohio, Indiana, Missouri, Iowa, and Kansas increased their supplies, and all the other States above named sent forward diminished numbers.

The trade in milch cows declined from the fact that fewer cows are kept in the city, the milk business being carried on to a greater extent by dairymen who raise their own animals or purchase them of original owners. A reaction in the sheep and lamb trade is apparent. Prices showed, at the close of the year, an upward tendency, indicating that the point of greatest depression had been reached. In hogs there was a large increase, as well as in the receipts of dressed hogs. The decline in prices amounted to about 2 cents per pound, live weight, during the past year.

The average price of cattle during 1871 was 12 cents; 1870, 14½ cents; 1869, 14⅗ cents; 1866, 16 cents. The decline of prices of live cattle induced a more extensive beef-packing at the West, yet the increase of numbers taxed quite heavily the capacities of all the railroads. The prices of sheep advanced fully 1 cent per pound during the past year.

The following table, compiled from the New York Tribune reports, shows the prices of cattle, sheep, and hogs at the close of each month of 1871:

Months.	Beeves.				Sheep.	Hogs.
	Common.	Fair to good.	Prime to choice.	Average.		
January	$0 08 to $0 11	$0 12 to $0 14	$0 15 to $0 16	$0 13¾	$0 05 to $0 08	$0 08½ to $0 08¾
February	08 to 10	11 to 12	14 to 15	12¾	5½ to 7½	7¾ to 8⅛
March	11 to 12	13 to 14	15 to 16	14	6 to 8	7½ to 8
April	11 to 12	13 to 14	14 to 15½	13½	6 to 8	7 to 7⅜
May	10 to 11	11 to 12	13 to 13½	12½	4½ to 6	5½ to 5⅞
June	9 to 10	11 to 12	12 to 13	11¾	4½ to 5½	4¾ to 5
July	6 to 8	9 to 11	12 to 13	10¾	5 to 6¼	5⅜ to 5⅝
August	6 to 8	10 to 11	11¾ to 12	10½	4½ to 6	5⅛ to 5⅜
September	6½ to 9	10 to 11	11½ to 12¼	10¾	4½ to 6½	5½ to 6
October	8 to 9	10 to 11	11½ to 12½	10½	4½ to 6½	4¾ to 5⅛
November	6 to 8	9 to 10	11 to 12	9	4½ to 6½	4⅝ to 4¾
December	9 to 11	11 to 12	12½ to 13	11¼	5½ to 7½	4⅞ to 5¼

The receipts of beef and of hog products for the past three years were as follows:

	1869.	1870.	1871.
Beef, packages	82,191	127,298	155,800
Pork, barrels	94,552	123,296	169,726
Cut meats, packages	83,971	98,262	180,919
Lard, packages	75,527	93,523	275,444
Lard, kegs	15,983	24,989	23,617

The horse trade of 1871 embraced the sale of 22,392 animals, for an aggregate sum of $5,552,200, each animal averaging $248. Of this, 12,000 are estimated for car and stage use, at an average price of $170; 5,500 were sold as heavy draught-horses, at an average price of $250; 3,500 were light-harness roadsters, averaging about $400; 260 were saddle-horses, averaging $350; 53 were reputed as fast horses, (trotting a mile in less than three minutes,) averaging $1,500; 904 were fine carriage-horses, sold in pairs, at an average of $1,225 per pair. The practice of selling horses by auction is on the increase in New York. One horse, during the year, sold under the hammer for $6,000; another for $4,500; others from $2,000 to $2,300.

BOSTON.

The following table shows the number of different kinds of live stock reported at the Cambridge and Watertown markets during the ten years ending with 1871. The marked feature of last year is an increase of almost 100 per cent. in the receipts of hogs over 1870.

Year.	Cattle.	Calves.	Sheep.	Swine.
1862	98,218	10,000	229,198	101,060
1863	110,815	16,005	250,597	91,840
1864	108,836	16,570	302,350	69,131
1865	117,866	17,798	341,381	99,537
1866	118,185	10,205	461,218	111,119
1867	107,866	12,387	421,940	106,673
1868	110,010	13,700	492,736	137,990
1869	129,353	13,000	440,404	169,010
1870	124,592	16,000	450,997	189,430
1871	129,147	13,230	489,065	351,307

Receipts of beef and of hog products for three years:

	1869.	1870.	1871.
Beef, barrels	24, 861	25, 858	27, 441
Pork, barrels	32, 387	24, 790	39, 754
Hams, casks	5, 777	3, 645	3, 988
Hams, barrels	3, 027	3, 887	9, 961
Lard, barrels	37, 040	39, 316	55, 622
Lard, kegs	11, 981	4, 340	1, 665
Cheese, boxes	140, 753	148, 760	202, 487
Cheese, casks	757	454	554
Cheese, tons	178	146	131
Butter, tubs	355, 552	394, 134	442, 318

PHILADELPHIA.

Receipts of live stock during four years ending with 1871:

	1868.	1869.	1870.	1871.
Beeves	90, 400	99, 486	117, 903	125, 333
Cows	9, 314	8, 055	8, 835	11, 150
Hogs	191, 900	176, 200	189, 500	199, 610
Sheep	417, 800	536, 500	682, 900	790, 200

BALTIMORE.

The receipts of beef cattle for the last five years were as follows. 1867, 55, 713; 1868, 75, 891; 1869, 91, 000; 1870, 89, 021; 1871, 88, 386. About half were required for the supply of the city and its vicinity. The remainder were forwarded to other markets.

The prices for cattle on the 1st of each month of 1871 were as follows:

Month.	Common.	Good.	Average.
January	$0 03¾ to $0 04¼	$0 05½ to $0 06½	$0 06⅛
February	4 to 4½	5½ to 6¼	6⅛
March	4 to 4¼	5 to 6⅛	5⅝
April	4¼ to 4⅜	5¾ to 6⅞	6⅛
May	4¼ to 4½	5¾ to 6¼	6¼
June	4¼ to 4⅝	4¾ to 6	6⅛
July	3½ to 4¼	4¾ to 6	6
August	3½ to 3¾	4¼ to 5½	5½
September	3 to 3¾	4½ to 5⅛	4⅝
October	3¼ to 4	4¼ to 4¾	4½
November	2⅞ to 3⅝	4¼ to 4⅞	4⅜
December	2½ to 3¼	4¼ to 5	4¼

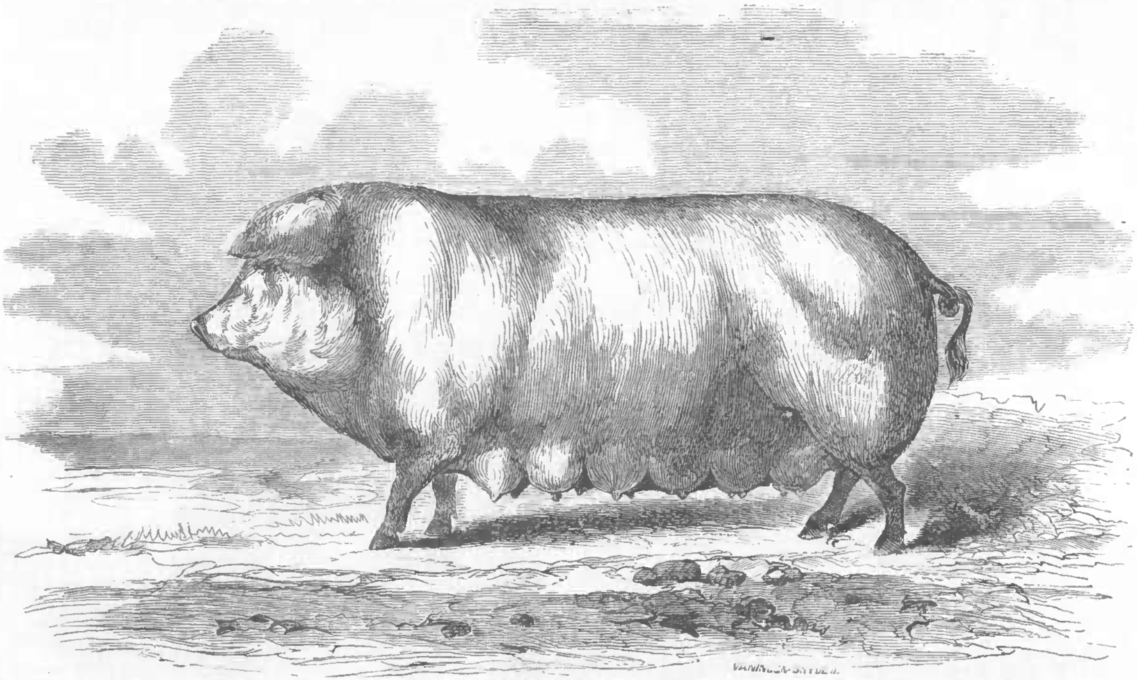
The prices of live hogs, per 100 pounds net, on the 15th of each month of 1871, were as follows: January, 9 to 9½; February, 10½ to 11½; March, 9¾ to 10½; April, 8 to 9; May, 7¼ to 8; June, 6¼ to 6¾; July, 6¼ to 7; August, 6 to 6¾; September, 6½ to 7¼; October, 6 to 6½; November, 5¾ to 6⅜; December, 6 to 6¾.

The receipts during the year were 307,436, against an estimated aggregate of 300,000 in 1870. The opening of railroad communications between the Northwest and the South has diverted a large amount of the trade in beef and pork. Formerly, Baltimore was a great distributing point of western provisions for the South. What was left of the trade was not very satisfactory to Baltimore dealers in 1871. The foreign trade is limited, but during the latter part of the year there was a marked increase in the shipments of lard to Liverpool.

CINCINNATI.

Receipts of cattle and sheep during the last five years, each ending August 31:

PLATE III.



CHESTER WHITE SOW, "MARY."

One year old. Owned by E. B. Ashbridge, East Goshen, Chester County, Pa.

Year.	Cattle.	Sheep.
1867	91, 946	91, 987
1868	87, 459	73, 097
1869	107, 813	117, 548
1870	107, 167	90, 205
1871	125, 771	134, 892

Prices of cattle August 31, 1871, per cental gross, extra shipping, $4.75 to $5; prime, $3.50 to $4.25; medium, $3 to $3.25; common, $2.25 to $2.50.

Sheep, per cental gross, choice, $4 to $4.25; prime, $3 to $3.50; common, $2.50 to $2.75. Lambs, per head, $2.50 to $3.75.

CHICAGO.

Receipts of live stock during 1870 and 1871 in Chicago:

Year.	Cattle.	Sheep.	Live hogs.	Dressed hogs.
1870	532, 964	349, 855	1, 693, 158	260, 214
1871	543, 446	308, 935	2, 382, 372	259, 206

SAINT LOUIS.

Prices of cattle, hogs, and sheep, at the beginning of each month of 1871:

Month.	Cattle.	Hogs.	Sheep.
	Per cental.	*Per cental.*	*Per cental.*
January	$2 75 to $6 00	$6 00 to $6 55	$1 50 to $4 50
February	2 60 to 6 50	6 75 to 8 00	3 75 to 5 25
March	2 50 to 5 50	6 30 to 7 00	2 00 to 6 00
April	2 75 to 6 50	5 50 to 6 50	2 00 to 6 50
May	3 25 to 6 87½	4 50 to 5 50	4 00 to 6 25
June	2 50 to 5 50	3 50 to 4 00	1 50 to 5 50
July	2 50 to 5 50	3 50 to 3 90	2 25 to 3 50
August	1 50 to 5 50	3 75 to 4 50	2 75 to 3 50
September	1 75 to 5 00	4 00 to 4 50	2 75 to 4 25
October	1 25 to 4 75	4 00 to 4 55	2 75 to 4 00
November	1 50 to 4 50	3 00 to 4 35	1 75 to 4 75
December	2 00 to 5 00	3 80 to 4 30	3 50 to 4 40

PORK PACKING IN THE WEST.

The number of hogs packed in the Western States, during the last two packing seasons, according to the record kept by the Cincinnati *Price Current*, is as follows:

States.	1870–'71.	1871–'72.
Ohio	764, 119	900, 484
Illinois	1, 234, 528	1, 630, 725
Indiana	425, 454	566, 134
Kentucky	288, 970	342, 562
Wisconsin	251, 400	334, 410
Tennessee	41, 270	42, 680
Iowa	183, 014	288, 580
Minnesota	14, 000	21, 000
Missouri	459, 155	639, 949
Kansas	30, 641	43, 044
Nebraska	2, 700	4, 890
Total	3, 695, 251	4, 868, 448 3, 695, 251
Increase	....	1, 173, 197

Number of hogs packed during these two seasons at the leading points of the above-named States:

Cities.	1870–'71.	1871–'72.
Chicago	918, 087	1, 225, 236
Cincinnati	500, 066	656, 841
Saint Louis	305, 600	419, 032
Louisville	242, 135	309, 512
Milwaukee	241, 000	315, 000
Indianapolis	105, 000	172, 100
Saint Joseph and vicinity	74, 360	118, 155

The number of hogs packed at Chicago, during the last ten seasons, is as follows: 1862–'63, 970,264; 1863–'64, 904,659; 1864–'65, 760,514; 1865–'66, 507,355; 1866–'67, 639,332; 1867–'68, 796,226; 1868–'69, 597,954; 1869–'70, 688,140; 1870–'71, 918,087; 1871–'72, 1,225,236.

The packing season of 1871–'72 was marked by an unusual steadiness of prices during its continuance. Between November 1, 1871, and March 1, 1872, mess pork ranged from \$12.12$\frac{1}{2}$ to \$13.40 per barrel; lard, from 8$\frac{3}{8}$ to 9 cents per pound. During the season of 1870–'71 mess pork ranged from \$17.50 to \$24.50 per barrel, and lard from 11 to 11$\frac{3}{4}$ cents per pound.

The hog products of the last three packing seasons are as follows:

	1871–'72.	1870–'71.	1869–'70.
Mess pork, barrels	126, 059	98, 731	88, 894
Prime mess, barrels	19, 993	40, 837	10, 710
Clear middles, pounds	6, 235, 434	5, 278, 351	5, 324, 027
Short rib, pounds	31, 700, 039	30, 062, 824	18, 488, 965
Short, clear, pounds	24, 923, 980	12, 392, 937	3, 372, 884
Long, clear, pounds	18, 302, 005	6, 808, 832	542, 317
Stratford, pounds	1, 209, 025	343, 700	767, 019
Sweet-pickled, tierces	25, 475	31, 350	20, 978

The highest and lowest monthly average prices of each of the last ten years, at Saint Louis, were as follows:

Year.	Mess pork.	Clear sides.	Shoulders.	Lard.
	Per cental.	*Per pound.*	*Per pound.*	*Per pound.*
1862	\$9 45 5-11 to \$16 20 5-6	\$0 04 17-48 to \$0 06 25-48	\$0 04 3-8 to \$0 06 1-24	\$0 06 7-16 to \$0 07 7-8
1863	12 05 5-9 to 13 63	4 5-6 to 5 19-24	4 7-24 to 5 23-24	8 7-24 to 9 5-6
1864	30 75 to 34 08 1-2	15 3-4 to 17 5-6	13 5-12 to 15 21-24	15 3-4 to 17 43-48
1865	30 41 2-3 to 31 58 1-2	20 2-3 to 21 5-6	15 5-15 to 17 11-24	18 2-3 to 22 11-12
1866	28 72 11-12 to 30 52 11-12	17 45-48 to 19 7-24	13 5-8 to 15 37-48	17 1-6 to 19
1867	21 29 7-12 to 22 81 1-4	13 11-12 to 14 11-12	10 31-48 to 11 7-12	12 23-48 to 13 7-24
1868	25 62 1-2 to 27 95 5-8	16 to 16 3-4	11 11-12 to 13 7-16	16 13-18 to 18 17-48
1869	30 70 10-12 to 32 89 7-12	17 2-3 to 18 21-48	14 3-4 to 15 1-3	17 11-16 to 19 1-12
1870	26 21 7-8 to 27 [illegible]7 11-12	17 5-12 to 18	12 7-20 to 13 1 3	15 7-16 to 15 37-40
1871	19 31 1-4 to 22 18 3-4	10 3-4 to 12 3-4	8 1-2 to 9 3-8	11 3-8 to 13 3-4

The publication of this volume is made this year too early to include the usual record of agricultural exports of the fiscal year. Much other matter has been deferred, either from lack of space or incompleteness of data; and a portion of the statistical work of the year will be found in the report of the editor.

J. R. DODGE, *Statistician.*

Hon. FREDERICK WATTS, *Commissioner.*

REPORT OF THE ENTOMOLOGIST AND CURATOR OF THE MUSUEM.

The study of practical entomology, or the habits and instincts of a few small and insignificant insects, or "bugs," as they are more generally but erroneously called, appears to the casual observer to be a matter of so trifling importance as to be totally unworthy the attention of any man of common sense. Uneducated persons are apt to scoff at the idea of spending half an hour in carefully observing their habits and transformations, and deem it so much time wasted that might be more profitably employed in hoeing potatoes or planting cabbages; and yet the whole crop of these very potatoes, planted with so much care, labor, and expense, may be totally ruined in a few days by the "blister flies," or "Colorado beetles." When the crop is entirely destroyed, it then appears to be a matter of considerable importance to learn from practical entomologists, that a slight sprinkling of Paris green mixed with flour, when the beetles first appeared, might have saved the whole crop; or, that the pretty white butterfly, that flutters gaily about the flowers in spring, is in reality the parent of the myriads of green worms that in the fall of the year eat into the heads of the cabbages, totally ruining them for market purposes. When the immense amount of injury done by insects is carefully considered, we shall feel fully convinced that, could any means be devised to allure them to their destruction, by appealing to their tastes or habits, or by driving them away by means of something to which they have an antipathy, and which can only be done by a close study of their instincts, one very important point has been gained in effecting their destruction.

Many farmers regard insects as trifles until their wheat is ruined by the wheat-midge, or their orchards by the curculio and coddling-moth; then, and only then, do they ask, why cannot something be done at once to destroy these pests; and they complain that entomologists have not invented something to destroy noxious insects, at one blow, without having to accomplish it by hard work. Shaking the plum-trees every morning over a curculio-catcher is too much trouble. Keeping hogs in orchards injures the grass; fences have to be made and repaired; in short, there is always some drawback to offset the benefit when any but the most simple remedy is offered to the public, which may be used without much labor or expense.

In forming plans for the destruction of noxious insects, one fact must be observed, and that is, that when insects first appear in the spring, there are very few of them; and that for one insect in April, there will be thousands in the autumn, if they are allowed to multiply; the great object, therefore, is to destroy the parent insects, before they have had time to deposit their eggs and to spread over the whole garden. A few minutes spent in destroying a caterpillar's nest in our own or a neighbor's fence-row, early in the season, may save whole orchards in the following autumn, or if the black and yellow butterfly hovering over your parsley is killed in April and May, your celery plants will not require "worming" in August. Take the first brood of squash-bugs and burn them, as they hybernate under old stumps and rubbish in the winter, or kill the first few that crawl over the vines in the spring, and destroy the leaves on which the golden-colored eggs are deposited in

clusters, and, unless you have careless neighbors, your own plants will be comparatively free from them in the autumn. Persons not having a thorough knowledge of the habits and instincts of insects are very apt to recommend remedies that are excellent, theoretically, but perfectly absurd practically, as may be shown by the following example, in which a closet naturalist recommended a plan to prevent the curculio from stinging the plums; he argued that, having no visible wings, the insect could not fly, and that as the grub went into the ground in the fall, and issued out of the earth the next spring as a perfect insect, of course it must crawl up the trunk of the tree to get at the fruit; he, therefore, recommended swathing all the trunks of the plum-trees with loose cotton batting, over which the beetle could not pass. The plan was highly recommended as a practical means of ridding fruit-growers of the curculio, but the fact is that this insect, although apparently wingless, has a pair of very hard wing-cases which, when closed, exhibit no visible suture, and a pair of well-developed membranous wings under these hard shelly wing-cases, and it is both able and willing to fly up the tree, without taking the trouble to cross the batting at all; moreover, the cotton when examined was found to contain the larvæ of "lady birds," and other beneficial insects, which feed altogether on plant-lice, and which had evidently been shaken by the wind from the tree to the ground, and were therefore unable to re-ascend to the feeding-places on the aphis-infested leaves. Another closet naturalist advised plum-growers to hang wide-mouthed bottles, half filled with sirup or sugar and water, as a trap for the curculio, arguing that all insects being fond of sweets, the curculio of course would be attracted by the scent of the sweetened water, endeavor to reach it, fall in, and perish, while the real fact was, that all the bottles, when examined, were found to be filled with drowned insects, but not a single plum-weevil among them; it did certainly attract and destroy many noxious insects, but at the same time a great number of hive-bees were lured to their destruction. It must also be remembered that all insects are not alike injurious to our crops, but that there are many that feed entirely on the injurious species, and were it not for their assistance we might wage war in vain against our numerous insect foes and it is only by studying their habits and instincts that we can learn to distinguish our insect friends from our enemies, or which to protect and which to destroy. Again, from a careful study of the natural history of any insect, we learn at what period of its existence it can most readily be destroyed, whether as egg, larva, pupa, or in the perfect state. If the eggs are deposited in a case which remains on the tree all winter, as in the "basket or hang-worm," then the whole brood of six hundred to eight hundred can be killed by merely collecting these cases in the winter and burning them. If caterpillars congregate together at certain times and in certain places, advantage may be taken of it to kill the whole brood at once; if the pupæ are formed just under the surface of the soil in the autumn, spring-plowing or rolling will be very apt to destroy them; and if the perfect flies are attracted by lights, numbers of them may be entrapped by first learning the time of night that they appear.

To give some idea of the immense loss caused by noxious insects, Mr. Walsh calculated that the United States suffer from the injuries of noxious insects to the annual amount of three hundred millions of dollars, and adds that he is "by no means claiming that it is possible to save all this enormous sum, but if diminished only one-half per cent., the nation would gain every year a million and a half of dol-

lars." When speaking of the wheat crop in the State of Illinois, and the insects injuring it, Mr. Walsh further says:

> We arrive at the astounding conclusion that in one single year the State saved upon one single crop the value of 20,000,000 bushels of wheat through the absence of certain tiny insects, not one of which is as large as a grain of rice; and that, taking the average of years, we may safely assume that a fifth part of the wheat crop is destroyed by insects; and even at the low price of 75 cents per bushel, we have over four and a half million dollars' worth of wheat annually destroyed by little vermin "it is not worth our while to notice."

Mr. Walsh also estimates the whole annual damage done in one year to the State of Illinois at not less than $20,000,000. Mr. J. R. Dodge, statistician of the Department of Agriculture, states that "a low average of the value of the cotton crop for many years past would be two hundred millions of dollars; 20 per cent. would not be too large an estimate of loss from insects when most prevalent, involving a destruction of forty millions of dollars; and when least prevalent, with only 5 per cent. of loss, a waste of ten millions would result."

The American Entomologist for September, 1868, states that, "at a recent meeting of the New York Agricultural Society, Senator A. B. Dickinson gave it as his deliberate opinion that the writings of Dr. Fitch had saved annually to the single State of New York the large sum of $50,000," and not a dissenting voice was raised against the statement.

The above estimates prove conclusively the importance of studying the habits of insects, that remedies may be suggested which will partially prevent or lessen the losses caused by their depredations. In this work the intelligent farmer can render material assistance by noting, in his nearest agricultural paper, the date of the first appearance of any noxious insects, observing their habits as far as possible in the field, finding out where and how they pass the winter, and what plants they are particularly partial to, or feed upon, in the absence of the cultivated crops; and especially giving the results of the various remedies tried to eradicate them. It would also be well to find out what birds or animals are particularly engaged in feeding on insects themselves, so that they may be protected from amateur or city gunners, who prowl about shooting even warblers and wrens—birds whose whole lives are devoted to destroying insects alone, and whose bodies, as an article of food, scarcely weigh as much as the charge of shot it takes to kill them. Insectivorous birds are the best allies of the farmer, and were they all destroyed there is little doubt that it would be almost impossible to raise certain crops. Birds certainly may and do take a little fruit and grain, but the question arises, should we have the fruit or grain to be taken, had not the birds first cleared our trees from caterpillars and other insects, and our grain-fields from the wire-worm, white grub, and cut-worm?

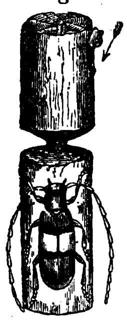
During the past season a monthly record has been kept of the principal insects sent to the Department for identification, or as being especially troublesome, together with specimens of the injuries done by them.

Many small branches or twigs of pear, persimmon, and various other trees, deeply cut into and girdled by some insect, were received during autumn, with letters making inquiry as to the insect causing the injury, and the best mode of preventing its ravages. It appears, from the correspondence, that the "trees are much more injured this autumn by it than they were a few years ago;" thus proving that the insect is increasing in numbers, and, if not prevented, may eventually do much injury. A correspondent at Richmond, Virginia, writes that the elm, persimmon, &c., have been much injured in that neighborhood. Mr. G. F. B. Leighton, of Norfolk, Virginia, states that the pear, hickory, elm, and persim-

mon are attacked in his vicinity, but that the persimmon receives the greatest injury.

The beetle that thus girdles the twigs is the perfect insect of the so-called "twig-girdler," *Oncideres cingulatus*, Say, (Fig. 1,) a medium-sized, long-horned beetle, of a chestnut-brown color, and having a broad, lighter colored band across the wing-covers. The female beetle first makes a perforation in a branch, generally just below a bud; she then deposits an egg in this perforation, in one case even making as many as six perforations, in which eggs were deposited below the buds in a single branch, not more than a foot in length, sent by Mr. Leighton.

Fig. 1.

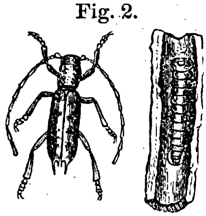


After the insect has deposited her eggs, she proceeds to gnaw all around the branch, thus forming a circular cut or incision, about one-eighth to one-tenth of an inch in width, below the place where the eggs are deposited, so that the exterior part or end dies; the larva, when hatched, feeds on the dead wood, which sort of food appears to be essential to its growth. The principal injury is said to be done in August and September. They have also been found to injure walnut and apple trees as well as those above mentioned.

A great number of the perfect beetles that had just changed were found in Maryland in twigs broken from a large hickory-tree, and lying on the ground beneath it. The best way to eradicate this insect is to cut off all such branches and twigs as have the least appearance of having been girdled, and to gather up all fallen branches and burn them immediately, as the eggs or larvæ of the next year's generation are contained in these twigs, and, if allowed to remain undisturbed, would produce a race of beetles next season which would girdle all the trees in the neighborhood. The best time to prune off the infested branches is after the leaves have fallen from the trees, as the injury can be more plainly seen than when the tree is in full leaf.

There is another long-horned brownish beetle which also cuts off the branches of oak, apple, peach, hickory, and chestnut. This beetle, which is known as the "oak-pruner," *Elaphidion villosum*, Fab., (Fig. 2,) (*Stenocorus putator* of Peck,) does not make the incision from the outside of the branch like the twig-girdler above mentioned, but the larva cuts the twig from the inside. The egg is deposited in July, on a twig near the extremity of a branch. The larva, when hatched, penetrates into the wood, and forms a cylindrical burrow several inches in length in the interior of the branch, and, when full grown, eats away parts of the wood of the branch in which it resides, from the inside, leaving only the bark untouched, so that these branches are broken off in autumn by the first strong wind, and fall to the earth with the larvæ yet in them. Professor Peck considered that this was done in order that the branch might retain sufficient moisture from lying on the damp ground to enable the pupa and insect to be perfectly developed. If this insect should increase so as to become very injurious, it may readily be destroyed by gathering up all fallen branches under the trees in winter or spring, before the perfect beetle is developed, and burning them immediately. If such fallen branches are examined in early spring, they will be found to contain either pupæ or perfect beetles, which, if not destroyed, would, next season, deposit eggs on the neighboring trees.

Fig. 2.

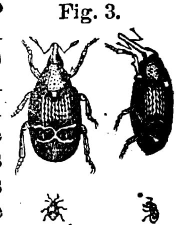


The white poplar (*Populus alba*) in this neighborhood is subject to a

species of shedding of the twigs, but this does not appear to be caused by any insect, as, upon examination of the fallen twigs, no eggs or vestiges of the work of any insect could be found, and the only peculiarity exhibited by the twigs is a very great enlargement or swelling just above or at the place where the twig is broken.

In May a communication was received from Mr. B. Bryan, of Silver Hill, Maryland, stating that he had observed some small insects injuring his strawberries soon after they had commenced blooming. In his letter he says: "I noticed that the blossoms were dying, and, upon examination, found that a small insect somewhat similar to the curculio was stinging or piercing with its snout the blossom-bud and foot-stalk of the blossom-bud, thereby causing the death of the blossom." "I found these little curculios in all parts of the field where the berries were growing, and the damage was the same all over the place, and on some vines as high as two-thirds of the blossoms were killed." Mr. Bryan also states that if these insects deposit eggs in the punctures they make, they fail to hatch in almost every instance. On searching a neighboring patch of strawberry plants, he "failed to find any of these small curculios." The insect sent proved to be *Anthonomus signatus*, Say, (*bisignatus* of Schönher,) (Fig. 3,) and as yet must be extremely local, for although diligently searched for in several strawberry beds, both in this neighborhood and in Maryland, not one of these insects could be found. In the specimens of blossoms injured, no eggs or vestiges of larvæ could be found, thus proving that the punctures are merely made for the sake of feeding upon the plant. As this insect has not yet been mentioned as injuring the strawberry, it has been thought advisable to draw the attention of horticulturists to Mr. Bryan's letter, since the fact of this beetle having injured his crop so materially may perhaps account for the failure of the strawberry crop in certain localities. This insect is about .11 inch in length; including snout, .15 inch; oval in shape, the thorax one-half the width of the body; elytra or wing-covers reddish brown, with two large irregular oval spots of a darker shade, margined with white, occupying a space a little below the center of each wing; inner margin around the scutellum same color as the spots; scutellum, or triangular spot between the base of the wing covers, white; thorax, head, and legs dark chestnut brown, coarsely punctured; under side of body clothed with fine whitish hairs; end of abdomen, reddish brown, They vary much, some of them being almost entirely without the irregular oval spots on the wing-covers, and of a nearly uniform chestnut-brown color.

Fig. 3.



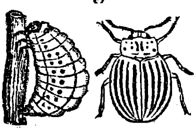
The only remedy that can be suggested, should these insects become so numerous as to seriously injure the crops, would be to sweep a small net of muslin over the flowers once or twice a day, gently, so as not to injure the flowers, yet with sufficient force to drive all the beetles in or on the plants into the net, and then burn or otherwise destroy them. Perhaps lime or ashes dusted over the plants, when in flower, might have some effect on them, and cause them to leave the strawberries for other flowers more congenial to their tastes.

Although last year a short account was given in the annual report on the Western Colorado potato-bug, or "ten-lined spearman" of Walsh, (*Doryphora decem-lineata* of Say,) the insect does not yet appear to be understood; and, as many communications have been sent to the Department during the last season stating that it has appeared in Massachusetts, Pennsylvania, and other Eastern States, and as, in all these instances, other and

totally different insects have been mistaken for it, it may be well to give a short account of it again, with figures, for the benefit of those farmers not possessing a copy of the report for 1870, or that have had no opportunity of seeing the insect or of learning anything about its general natural history.

The *Doryphora decem-lineata*, Colorado, or western ten-lined potato-bug,(Fig. 4,) was described by Say in the Journal of the Academy of Natural Sciences, in 1823, as occurring in Missouri and Arkansas, and was so named from the ten black lines on its wing-covers, five on each side. One of the first notices of its appearance, as a destructive insect, was in 1861, when Judge Edgerton described it as being very destructive to the potatoes in Iowa; and, in 1862, it was reported by Thomas Murphy, of Atchison, in Kansas, as doing much damage to the crops, and being very numerous. The insect is said to have first fed on a species of wild potato, growing out in the far West, and is stated to have traveled east about three hundred and sixty miles in six years, or at a rate of about sixty miles a year. They are now said to be found as far north as Canada, as far east as Ohio, and, according to some papers, (but doubtful,) even in New York and Pennsylvania. In 1864 Mr. Walsh calculated that, if not checked, they would reach the Atlantic States about the year 1880. The eggs, to the number of seven hundred to twelve hundred, are deposited on the young leaves of the potato. These eggs are attached by one end to the under side of the leaves, usually in clusters of one to two dozen. The larvæ hatch out in a few days, and feed from seventeen to twenty days. They then bury themselves in the earth, where they change into pupæ, and remain as pupæ from ten to twelve days, and finally emerge from the earth as perfect beetles to deposit more eggs for a second generation. In order to give some idea of their powers of multiplication and the injury effected by them, the Canadian Entomologist states that all their transformations are effected in fifty days, so that the result of a single pair, if allowed to increase without molestation, would, in one season, amount to over sixty millions. And Mr. Walsh, after a careful examination of facts, states that in one year (1866) these insects had destroyed one and a quarter million dollars' worth of potatoes in one small portion of the United States which came under his observation. The insect, after laying its eggs, does not die immediately, Professor Daniels, of Wisconsin University, having kept a female alive six weeks without food after she had laid twelve hundred eggs. There are said to be three broods annually in Missouri and Illinois, the last brood remaining underground all winter, and appearing as perfect beetles the following spring. This insect is stated to possess poisonous properties when incautiously handled; but the Canadian Entomologist has been unable to find any evidence of poisonous properties, and doubts the statement. It feeds upon the potato, tomato, egg-plant, thorn-apple, black henbane, &c., &c.

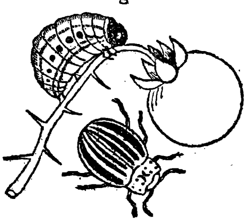
Fig. 4.



There are several parasitical insects which destroy the Colorado potato-bug, but their numbers will not admit of their being enumerated in this article. Among the principal ones are several plant-bugs, *Arma*, *Harpactor*, &c.; some beetles, *Lebia*, *Coccinella*, &c.; a two-winged fly, *Tachina*, besides several other insects which prey upon it in the larval state, and serve essentially to lessen the number of these pests. These insects should by all means be protected in the potato-fields, and suffered to increase. The larva of the Colorado potato-bug is at first dark reddish-

brown, but becomes paler, and brightens as it matures. The head is black, and it has a ring of black on the first segment of its body, and two rows of black spots on each side. The perfect insect is about half an inch in length, of a thick, oval shape, and of a yellowish cream-color, with ten black lines running lengthwise down the wing-covers. The head and thorax are of an orange-brown color, spotted and marked with black. There is another insect closely resembling the true Colorado bug in form, coloration, and markings. This is called the *Doryphora juncta*, (Fig. 5,) and may be distinguished by having the second and third stripes always united behind, and sometimes before, giving it the appearance of having only eight stripes instead of ten on the wing-covers. This insect has not yet been reported as having done any material injury to the potato, although in Alabama it has been said to injure the potato slightly, and is found in Maryland, Virginia, and South Carolina, feeding on the *Solanum carolinense*, and sometimes injures egg-plant in the South.

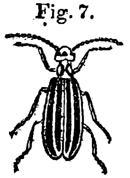
Fig. 5.



A second insect, the three-lined potato-beetle, (*Lema trilineata*,) (Fig. 6,) has also recently been mistaken for the Colorado bug, but may readily be recognized by its smaller size, more elongate form, and having only three longitudinal black lines on its reddish-yellow wing-covers. The larva may also readily be distinguished by its habit of carrying a disgusting mass of excrement on its back, and by its smaller size. Some of the cantharides, *Epicauta vittata*, (Fig 7,) and *lemniscata*, are also sometimes confounded with the Colorado beetle by farmers; and, although they are striped in a similar manner on their wing-covers, they may be known by their much narrower and elongate form and narrow thorax. The Colorado bugs are partial to certain varieties of potatoes, such as the Mercer, Shaker, Pinkeye, &c., avoiding as much as possible the Peachblow, Early Rose, Peerless, Chili, &c., when other varieties are to be obtained.

Fig. 6.

Fig. 7.



As a remedy, Professor Verrill recommends Paris green, mixed with eight to twelve parts of wheat flour, or with three parts of wood ashes, to be dusted over the plants when wet with dew; he, however, prudently adds: "It may be questioned whether it is safe or advisable to mix dangerous mineral poisons with the soil, for the arsenic and copper will remain in the earth, or may be absorbed by growing vegetables, or cause mischief in other ways." The American Entomologist also states that "Paris green (arsenite of copper) is a slow but dangerous poison; and when dusting plants with it the greatest care should be exercised, so that the wind may not carry it toward the person of the operator, and it may injure the soil if used repeatedly." In proof of this, peas planted at the Department of Agriculture, in soil mixed with Paris green, rotted immediately and would not germinate, while those in unadulterated soil grew finely and flourished, but died immediately when transplanted into the soil mixed with Paris green. This dangerous remedy has already been used to such an extent that in an entomological paper it is stated that 1,200 pounds has been sold in one season at La Crosse, Wisconsin, for the destruction of these potato-bugs. Professor Cook, of Michigan Agricultural College, reports that some of their potato-vines and egg-plants were totally ruined by a too free use of Paris green mixed in the proportion of one part of the mineral to

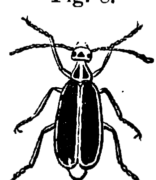
five parts of flour. Mr. H. H. McAfee, superintendent of the experimental farm of the University of Wisconsin, disapproves of the use of Paris green on account of its poisonous properties, and recommends hand-picking and destroying the beetles when they first appear; he also states that the potatoes are often watery, rank, and of a bad flavor where the Paris green has been used. Mr. Riley says: "Watch for and destroy early beetles, and ensnare as many as you can by making small heaps of potatoes in the field planted; to these the beetles will be attracted for food, and may readily be killed in the morning." Paris green, (Scheele's green,) he states, if used too abundantly, will kill the vines, and recommends it to be used with six to twelve parts of flour, ashes, plaster, or slaked lime. He also says it is highly improbable that any substance, sprinkled either on the vines or on the ground, will ever accompany to the table a vegetable that develops under ground; or, in other words, that the arsenic cannot be absorbed by the plant to render the root in any degree poisonous. The Canadian Entomologist also recommends Paris green, mixed with flour, ashes, or air-slaked lime, but states that flour is much the best when mixed in the proportion of one part of Paris green, by weight, to ten or twelve parts of flour, dusted over the plants when the dew is on the foliage, from an ordinary flour-dredge. Three pounds of Paris green to thirty or thirty-six pounds of flour is sufficient for an acre of potatoes. It also states that it is not dangerous if carefully used.

Several substitutes for Paris green are also mentioned, among them arsenic itself, (arsenious acid,) which may be used in the proportion of one ounce to a pound of flour, but it should be colored black with charcoal or some other coloring matter, to lessen risk of accident from use. Powdered cobalt, or fly poison, was also tested, but it is a much dearer remedy. Bluestone (sulphate of copper) solution injured neither bugs nor plant. Bichromate of potash, dissolved in water, killed insects and plants. Powdered hellebore had a perceptible effect. Carbolate of lime varies much in composition and character; some of it was partially successful with the larvæ, but doubtful with the perfect insect. Ashes and air-slaked lime gave no perceptible results.

In summing up all the evidence on the subject of remedies, it appears that hand-picking, especially very early in the season, when the insects first appear, and before they have had time to lay their eggs, is highly advantageous, and that the use of Paris green is recommended by the best authorities; but that, when using this dangerous poison, the greatest care should be taken when dusting the plants that none of it is carried by the wind on the person of the operator, or on any neighbor's fruit, vegetables, or forage crops, and that it should be mixed with at least ten to twelve parts of flour, plaster, or some other material, and that an overdose is apt to kill the plants, besides leaving a residuum in the soil which may prove injurious to the crops.

Dr. E. Foster, of Louisville, Mississippi, sent a number of insects to the Department for identification, which he stated were very injurious to his egg-plants. These, on examination, proved to be the margined blister-fly, *Epicauta marginata*, (*cineria* of Leconte,) (Fig. 8.) This fact is merely mentioned here, as the insect generally feeds on the butter-cup, potato, &c., and has not hitherto been mentioned as injuring the egg-plant; it is very likely, however, as the egg-plant and potato are related, and both of these plants belong to the family of the *Solanaceæ*.

Fig. 8.



Another correspondent writes that after the frost had killed the vines, he observed numbers of the striped cucum-

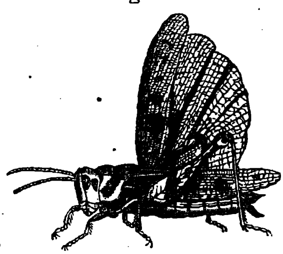
ber-beetle, *Diabrotica vittata*, (Fig. 9,) gathered together on the fruit of the pumpkin and squash which remained on the ground, and he suggests that if they do so every fall it would be a good plan to leave them a few soft pumpkins, and then go around every day and kill the insects gathered upon them, and thus lessen their numbers for the next spring. This plan might also be used to advantage with the common squash-bug, (*Gonocerus tristis* of De Geer.) It is at least worthy of trial.

Fig. 9.

No new remedies have been suggested for the destruction of the plum-curculio, but many of our correspondents speak highly of having plum-orchards fenced in and made a pasture for hogs, taking care, however, that the plum-trees shall be protected by stakes from injuries caused by the swine rubbing against the trunks. The so-called "Ransom remedy," laying chips or pieces of bark close around the tree early in the season, when the curculio first issues from the ground, under which they seek shelter during cold nights, and from whence they can readily be taken early the next morning and killed, would no doubt serve to diminish their numbers early in the spring; but we shall have to rely on shaking the trees into a curculio-catcher, or the hog-pasture system later in the summer, or at least until the two parasitic four-winged ichneumon flies (*Sigalphus curculionis* of Fitch, and *Porizon conotracheli* of Riley) have multiplied to such an extent as to be really of much utility.

A letter written in June, from Mr. Alexander S. Taylor, of Santa Barbara, California, gives a very interesting account of the ravages committed in that State by the Pacific migratory locust or grasshopper, which he erroneously supposed to be merely a variety of *Caloptenus spretus*, (Uhler,) but which has been decided to be *Œdipoda atrox* of Scudder, (Fig. 10,) by Rev. Cyrus Thomas, who has made this family his especial study. Mr. Taylor writes that "this year the insect appeared simultaneously in the Salinas, and in San Joaquin, Los Angeles, Sacramento, and Santa Barbara Counties, in May and June." In Mr. Scudder's notes on the *Orthoptera* collected by Hayden's Geological Survey in Nebraska, we find the species mentioned and described, and in the same article Mr. Scudder gives quotations from Mr. Taylor in the Smithsonian Report for 1858, and from the California Farmer, of January 15, the same year, from which it appears that the insect was exceedingly numerous and destructive before the present season. In July, 1865, the Sacramento Union stated that for about three hours in the middle of the day the air, at an elevation of about two hundred feet, was literally thick with them, and great numbers fell in the streets, absolutely taking the city by storm; they then commenced their wholesale destruction of everything green in the neighborhood, their flight *en masse* resembled a thick snow-storm, and their depredations the sweep of a scythe. In the year 1855, in the North Sacramento Mountains, they are said to have been "as thick in the heavens as flakes of snow in a wintry storm," and in the Sacramento Valley, "whole orchards, gardens, and vineyards were consumed by them; entire fields of young grain, of crops, and vegetables, were eaten up within the space of a single day, leaving the ground like a wilted, blackened desert, and in some parts of the valley, they annoyed the passengers and horses of the public stages to such an extent as to cause the greatest inconvenience, and appear, in some cases, to have positively endangered human life."

Fig. 10.

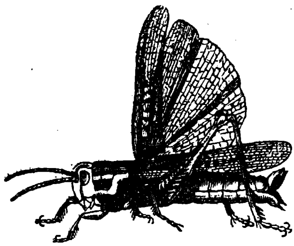


A gentleman residing in Colusa County, in the Sacramento Valley, in the summer of 1855, informed Mr. Taylor "that these insects appeared to rise out of the eastern boundary of the valley, where it is hot, dry, and sandy, and that on some days they filled the air so as to obscure the sun; they consumed all garden vegetables, the leaves and bark of the elder-tree, and the young leaves and bark of the small branches of cottonwood, willow, and even the soft green parts of the tules or bulrushes in Stony Creek. In Colusa County their dead bodies were seen, at one time, completely covering the surface of the water for miles in extent. In some parts of the valley they ate through gauze and textile coverings of all kinds, which had been used to shield animals and plants from their attacks."

From Mr. Taylor's account in the Smithsonian Report for 1858, it appears that there are at least three species of grasshoppers or locusts in California and Oregon which are very injurious to the crops, but as there are no names or accurate descriptions given, it is extremely problematical which of them it is that does the most injury. At the same time his letters were written to the Department, however, he sent two bottles of the insect figured (see Fig. 10) as specimens of the grasshopper he wrote about, and named them the Pacific migratory locust, and he says it is undoubtedly an indigenous species, as it was known to the early colonists and missionaries as far back as 1730.

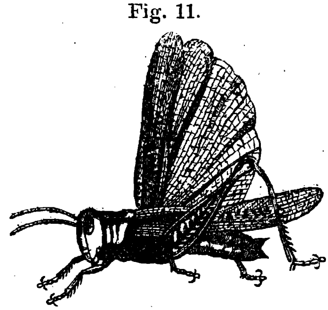
This grasshopper, or locust, is a little over an inch in length; is of a pale brownish-yellow color, with several small, roundish, brown spots, and a large brownish mark on the upper wings, and a dark fuscous spot behind the eye. It bears a very strong resemblance to *Œdipoda pellucida* (Scudd.) of New England. Indeed, had these locusts not come from California direct, and from good authority, they might readily have been mistaken for the last-named insect. It does not appear that any steps have yet been taken to destroy these insects in California, but the same remedies used for destroying the *Caloptenus spretus*, (Uhler,) or hateful grasshopper, might be adopted. It is of great importance to find out where they live when young and in the wingless state, as it is at this time—or when in the egg, just below the surface of the earth—that they may be destroyed most readily.

Fig. 12.



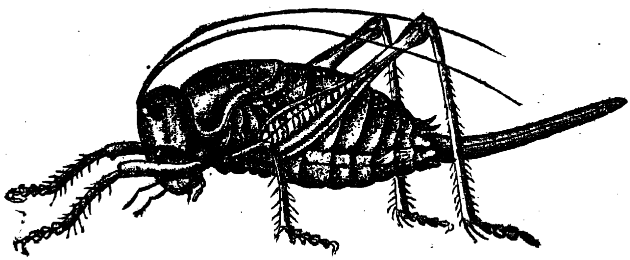
There are three grasshoppers or locusts very similar in size and form, now known greatly to injure the crops in the United States, and we give figures of them all in order that our readers may be able to recognize them. First is the *Caloptenus spretus*, Uhler, (Fig. 11,) or western species, (Agric. Rep. 1870, p. 76,) commonly known as the hateful grasshopper, and found in the States west of the Mississippi, and in the Rocky Mountains, in immense swarms, and which is distinguished by its length of wing from the second, or common eastern species, *Caloptenus femur-rubrum*, Har., (Fig. 12;) the red-legged grasshopper, which has shorter wings, but otherwise is almost identically the same as the above; and lastly, *Œdipoda atrox*, (Scudd.,) the Pacific species, (Fig. 10,) mentioned above.

Fig. 11.



In common with the grasshoppers which are so numerous and destructive in the Western States, there is another orthopterous insect which swarms in untold numbers in Southern Idaho and Utah, and is known by the common name of "cricket." This is the *Anabrus simplex* of Haldemann, (Fig. 13,) and is mentioned in Stansbury's Great Salt Lake Expedition. Rev. Cyrus Thomas, who has studied the habits of this insect in Utah, states that it is found on the ground in immense swarms, and that in two instances he has seen armies of them at least two hundred to three hundred yards in width, packed closely together,

Fig. 13.



moving across the road, apparently in search of water, as there was a creek a short distance in the direction in which they were going. The vegetation of the neighborhood was coarse grass, but Mr. Thomas states that he could not say positively as to their eating it or damaging the vegetation to any considerable extent, although it is highly probable that they do, as they appear to be almost omnivorous, collecting in great numbers on the dung dropped by horses, and feeding upon it. In several instances they were observed catching and eating the *Cicadas*, which were also in immense numbers on the bushes. The eggs are laid in the open plains, and in the act of deposition the ovipositor of the female is placed in an almost perpendicular position, being inserted into the earth nearly its whole length.

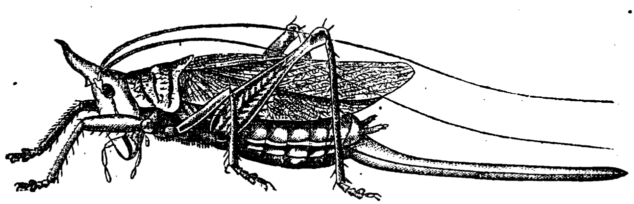
Mr. James McKnight, who lives in Salt Lake City, states that when the Mormons first emigrated to Utah this cricket appeared in immense swarms, destroying their whole crops of wheat, &c., and that the second year they also appeared, but providentially, or miraculously, as it was deemed by the Mormons, vast flocks of white gulls suddenly appeared and destroyed the crickets to such an extent as to almost eradicate them for the time being, thus saving the remainder of the crop, upon which alone the half-starved Mormons had to rely for food for the next season. Since that time these birds are held almost sacred in Utah. This so-called cricket, *Anabrus simplex*, can readily be distinguished from another brown cricket-like insect, which also inhabits Utah, *Udeopsylla robusta*, which differs from the first-mentioned by being of a mahogany color, and by having sharp spines on the under side of the posterior thighs. It is never so numerous, but being found in the same section of country these different insects have been frequently confounded by the common people. These "crickets" are eaten by the native Indians, generally roasted and pounded into a coarse-grained

meal, a sample of which, from Camp Harney, Oregon, is on exhibition in the museum of the Department, know as "pulverized crickets," among which the heads and legs of *Anabrus simplex* are very abundant.

In an agricultural journal a notice appears that "a machine has been invented at Salt Lake City to kill grasshopers, the great pest of that region, and consists of a frame drawn by two horses, having an apron projecting forward close to the ground to scrape up the locusts, with a hood above it, forming a box, open in front. At the rear of the machine is a pair of rollers geared together, the upper one driven by the carrying-wheels, of which it forms the axle. Whatever finds its way into the front of the machine is passed between these rollers and effectually destroyed." Such a machine might be of utility where the injury done by grasshoppers would warrant the expenditure necessary to make it, but in order to be of much use, it should be constructed so that the insects once swept into the mouth of the machine could not escape again. This might be accomplished by making the opening in front of double cloth, the inner net or bag being much shallower than the outer one, and ending in a small opening into the main bag like a fish-fyke. The insects should then be forced to pass between the rollers by means of something like a revolving scraper, or they would be very apt to clog up in the hinder end of the machine, and not pass between the rollers at all. For the flying grasshoppers, such as *Caloptenus spretus*, &c., mentioned before, it might be advisable to use the machine when they are yet in the larva or pupa state, and before they acquire wings, by means of which they would be able to escape being swept into the mouth of the machine.

Two full-grown specimens, male and female, of a very singular and apparently new orthopterous insect, somewhat resembling the *Conocephalus ensiger*, or conical headed sword-bearer, of Harris, (figured on page 164, 1862 edition,) and named by Rev. Cyrus Thomas, *Copiophora mucronata*, (Fig. 14,) were taken alive in the green-house of the

Fig. 14.



Department of Agriculture, in August and September, by Mr. J. H. Brummel. A short time previous two half-grown larvæ were found, but died soon after being captured; and the remains of a fifth full-grown imago were found, when cleaning out the flower-pots in the winter. These insects had injured the leaves of the coffee-plants, rose-apples, and bananas in the green-house, much in the same manner as is done by our native katydids, by eating holes in the leaves and by gnawing away the edges. Their jaws were remarkably strong and sharp, and when incautiously handled these insects bit so severely as to draw blood. The male insect was about 1.75 inch in length from the tip of the cone or horn on its forehead to the end of its wing-covers when closed. The female measured 3.05 inches to the end of the ovipositor, which itself was at least 1.25 in length. The general color of both male and female

was a light pea-green, and the wings were delicately veined with distinct nerves, resembling the venation of some leaves. A very marked feature in this insect, when alive, is that the labrum and clypeus are bright yellow, contrasting strongly with the jet black of the mandibles, which, together with the cone or horn on the top of its head, gives it a very remarkable appearance. This cone or horn, which is placed obliquely upward on the top of its forehead, forming a line with the face, is yellow beneath, black at the tip, and ends in an acute point, which is somewhat bent downward at its summit. No insect resembling it having hitherto been found in this neighborhood, there is but little doubt but that it has lately been imported with or on some foreign plants sent from South America or the West Indies, and as many exotic plants were sent by Mrs. Mechling from Balize, British Honduras, it is most probable that this grasshopper came in the egg state on some of the plants from that locality, and was hatched out last summer in the green-house. This fact alone admonishes us how careful we should be when importing new and valuable plants from abroad, for if a large insect, nearly two inches in length and fully the size of a katydid, can be so easily introduced, how much more readily the small and inconspicuous noxious insects hidden under the bark would be likely to escape notice until they had perpetuated their species so as to become partially naturalized and injurious to our plants. There is no danger, however, that this grasshopper will spread, as it is apparently very tender and accustomed to a tropical climate, and most probably would not withstand the rigor of our winters in the open air, and as all were killed, or caught as soon as seen in the green-house, there are probably none left to perpetuate their race. Mr. Thomas has described this insect under the name of *Copiophora mucronata*, in the Canadian Entomologist for January, 1872, and gives it as his opinion that it approaches nearer *C. cornuta*, found at Para, South America, or *C. gracilis* at Napo or Maranon, than any other species of which he has knowledge.

In connection with the subject of introducing new enemies to plants and vegetation in general from abroad, it may be advisable to mention that at the present time a very large and apparently new species of earth-worm, thought to have been first introduced in the earth in which some Japanese plants were imported in the expedition under Commodore Perry, has increased and multiplied in the hot-houses so much as to have become a veritable nuisance. This worm is probably the same mentioned in the English Gardener's Chronicle of April 24, 1869, by D. T. Fish, F. R. H. S., under the name of the eel-worm; its habits and appearance being almost identical with that in the hot-houses of the Department of Agriculture. Mr. Fish, after stating that it is very injurious to plants in pots, and had been known for twenty years, says that it is "probably a tropical relation of the common earth-worm, as it cannot live out of doors in the climate of England, and scarcely subsists in a green-house, but revels in the temperature of a plant-stove or orchideous house; it differs from the common worm in its mode of locomotion and in several of its habits. It comes out at night on walls, stone floors, &c., and is as quick as an adder or serpent in its movements when disturbed; it seems impossible to eradicate it, and it appears to breed with extraordinary rapidity, and is endowed with great muscular power, so much so that it is somewhat difficult to hold a large specimen between the finger and thumb. Lime-water, which is a soveign remedy against our common earth-worm, appears to have little influence on it, and the only effective means of destruction is to turn out the soil from the pot and catch and kill the intruder, taking care, how-

ever, not to knock or jar the plant, as this worm, instead of coming to the surface on being disturbed, like the common worm, will instantly recede to the center of the ball of earth and remain there undisturbed." In a later number of the Gardener's Chronicle for 1871, page 468, Mr. W. Baird speaks of a worm under the name of *Megascolex* (*Perichæta*) *diffringens*, found in three different gardens in England in hot-stove houses, which is probably the same worm as the "eel-worm" referred to by Mr. Fish.

Nothing of consequence has been added to our knowledge of the natural history of the white cabbage butter-fly, (*Pieris rapæ*, Linn.,)

Fig. 15.

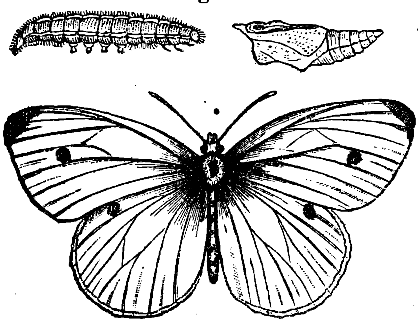
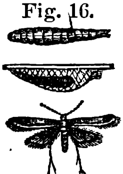


Fig. 15, mentioned in our last report, with the exception that Dr. Fitch states that it sheds its skin only three times, and he doubts whether it was introduced into Canada in the egg state, as formerly stated, but thinks it was probably imported as young caterpillars, as he says the insect does not remain in the egg state long enough to remain unhatched at the end of the voyage. He recommends as the most effectual means of destroying them the employment of children to capture the butterflies in a gauze net as they come around the cabbage lot, and entrapping the pupæ under boards placed purposely near the plants and elevated two or three inches above the earth; these boards should be examined every few days and the pupæ found made up underneath can readily be destroyed. Dr. Fitch also says that notwithstanding Mr. Riley states that white hellebore will kill these worms if sprinkled over them, he has tried it, and, although hellebore is effectual for the larvæ of saw-flies (such as the gooseberry or currant worm) the larvæ of Lepidoptera are unaffected by it. White hellebore certainly produces purgation when the worms eat it, but they always recover; so it is concluded that capturing the butterflies, searching out their eggs, larvæ, and pupæ, and destroying them when and wherever found, are the only effectual means of saving the cabbage crop. This injurious insect is said to have been captured in Baltimore, Maryland, last autumn, and, if so, proves that it is progressing rapidly to the south. There are two or more parasitic flies which serve to keep this pest in check in Europe, and Dr. Fitch mentions two spiders, *Theridion brassicæ* and *hypophyllum*, which live under the leaves and feed upon the young worms.

Complaints have been made by correspondents in New York and New Jersey of the injury done to cabbage in the autumn by the attacks of another insect, a small green caterpillar, that eats holes in the outer leaves, sometimes riddling them like a sieve. The caterpillar is about

Fig. 16.



0.35 of an inch in length, cylindrical in form, thickened in the middle, and of a green color. The moth produced from it was named *Plutella limbipenella* by Clemens, (Fig. 16,) and is described by Dr. Fitch, in the New York State Report for 1853, page 874, as the cabbage-moth, *Cerostoma brassicella*, and is closely allied to (if not synonymous with) *Plutella xylostella*, Linn., in Europe, and, if so, is another imported insect. When disturbed this caterpillar drops from the plant, but suspends itself by means of a silken thread. There are at least two

broods in one season in the more southern States. In the fall of 1870 it was plentiful in parts of Maryland, riddling the cabbages very seriously. The pupa is formed in a beautifully-constructed cocoon, woven of silk-like delicate open net-work on the leaves, and remains a pupa in the cocoon only a few days. The perfect insect is a small moth, with the upper wings of an ash-gray color, freckled on the disk and apex with black dots, and having a white stripe on the inner margin. The under wings are ash-gray. Washing or syringing the plants with whale-oil soap-suds or strong solutions of tobacco-water, would no doubt be of use if a disagreeable flavor was not given to the cabbage, which should be subjected to a thorough washing before using. The insect is subject to the attacks of a minute ichneumon fly; and the two spiders, *Theridion brassicæ* and *hypophyllum*, mentioned by Dr. Fitch in connection with the white-cabbage butterfly, will also, no doubt, be of service in destroying the small caterpillars.

A caterpillar injuring the foliage of the lilac has been described by Dr. Fitch under the name of the lilac measuring-worm. The moth produced from it is the *Priocycla armataria* of H. Schaeffer. The larva, which is a dark-brown measuring-worm, one to one and a quarter inches in length, resembles a dry twig, and has three bright-yellow spots on each side of the hind part of its body. It is found in August and September, and feeds on the lilac, eating only by night; during the day remains motionless, hanging head downward from the twigs. It feeds on the foliage from six to eight weeks. The pupa is formed in an open meshed cocoon, under fallen leaves and rubbish on the ground, and the perfect insect appears the following June, and deposits its eggs, to the number of about seventy-five, glued to the under side of leaves. The moth has scolloped wings, which are of a rusty-brown color, crossed forward of the middle by an oblique brown band, and by two blackish lines beyond the middle.

In regard to the cotton caterpillar, (*Anomis xylina*,) there have been but few complaints of injuries from correspondents, and those came principally from twelve counties in Mississippi, ten counties or parishes in Louisiana, and from some portions of Alabama, Texas, and Arkansas. On the whole, the insect appears to have done comparatively little havoc during the summer and autumn of 1871. It has been stated in some of our exchanges that a new method has been proposed to exterminate this insect in a wholesale manner by running a machine through the rows which will sprinkle a liquid poison over the foliage of the cotton plants, and thus destroy all the worms. Such an idea appears impracticable, in consequence of the difficulty there would be in running a machine of any size through the rows of closely-planted cotton, particularly if the plants were in full bearing and the bolls partially open; besides it would entail great expense and labor on the planter to procure a sufficient quantity of poison (and even of water in dry seasons) to thoroughly sprinkle all the plants on a plantation of only fifty acres; and we must also take into account the liability of this poisonous solution being washed off by the first heavy rain. Poisoning the caterpillars may perhaps answer, but only on a very small scale, and when they first appear in very small patches; but when they have once taken possession of the field in various places it is almost impossible to eradicate them without cutting down the infested spots, and burning up or passing heavy rollers over the trash. The planters of a neighborhood should club together and send their hands into the field to destroy the first crop of worms or insects on the plantations when they first appear, even if the whole crop has to be cut down and burned, and then pay the

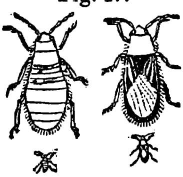
owner of the field a certain sum assessed on those whose plantations have been saved, and where the crops otherwise would have been utterly destroyed in a very short time, or as soon as the first brood of moths had made their appearance and deposited their eggs.

Reports of injury from boll-worm (*Heliothis armigera*) have been received from Florida, Georgia, Louisiana, and Arkansas, but they do not appear to have caused material damage to the crops.

The northern army or grass worm (*Leucania unipuncta*, Haw.,) has only appeared in very limited numbers; in no case have we heard of their occurring in such vast hordes as they did a few years ago, and, on the whole, we cannot complain of much injury done to either cotton or grass during the first season.

The chinch-bug, (*Ryparochromus leucopterus*, Say,) Fig. 17, mentioned in the last annual report, (1870, p. 89,) has been very destructive in Iowa, Kansas, and the Northwestern States. In addition to the remedies recommended last year, a correspondent writes that after trying other ways to prevent the chinch-bug from going through his corn he has tried salt, and found it effectually stops them. To do this, he takes a pail of water, with half a gallon of salt well stirred into it; with a small broom or bunch of feathers he then sprinkles well a row of corn just ahead of the bugs, taking care that the ground between the hills is well sprinkled with the brine, and he adds that "The bugs generally commence in a corn-field on one side and go through from row to row with almost as much precision as the plow-man plowing the corn." This remedy is merely mentioned, as, should the chinch-bugs appear in various places in the field at once, the remedy would be of little avail, and the brine, if too strong, would also undoubtedly injure the plants.

Fig. 17.



Letters have been received from various parts of the South, ranging from North Carolina to Texas, complaining of the destruction caused to cabbage and many other vegetables, by theHarlequin cabbage-bug, *Strachia histrionycha*, of Hahn, (Agric. Rept. 1867, p. 71.) The insect is mentioned in the American Entomologist, vol. ii, p. 80, as having been received from Dr. Lincecum, of Texas, as very destructive to cabbage, radishes, mustard, seed-turnips, and every other cruciform plant. Its natural history is as follows:

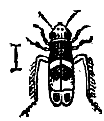
Fig. 18.

The eggs are deposited on end in two rows, cemented together, and generally placed on the under side of the leaf, in March. The larvæ mature in twelve to fourteen days from the time of leaving the egg, and feed upon the juices of the plant, which they extract by means of their piercer or sucker, and the punctures apparently poison the leaf, causing it to wither away from the wound. There are two broods in the season, and the insect passes the winter in the perfect state. Should they multiply so as to become a nuisance, as they hybernate in the perfect state, concealed beneath bark, under brush-heaps, or stones, like the cotton red-bug, it would be well, in winter, to search for them in such situations, and in spring to destroy them on their first appearance upon the young plants, before they have had time to deposit their eggs, and to multiply to such a degree as to render their extermination impossible. Mr. Lincecum states that these insects do not seem liable to the attacks of other insects, and that birds and domestic fowls will not touch them; and further, gives it as his experience that there is no other way to get clear of them but to pick them off by hand.

Communications having been received by the Department concerning the natural history and habits of the grape-vine hopper, improperly called the vine-thrips, a very small insect which for several years past has been extremely injurious to the foliage of the cultivated grape-vines by puncturing the leaves and sucking out the sap, it may be well to give a short history of the insect, from the egg to the full-grown imago, and the various remedies already proposed to destroy them.

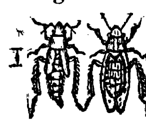
The grape-vine hopper, *Erythroneura (Tettigonia) vitis* (Fig. 19) is a very small insect, about 0.13 inch in length, of a pale yellow color, with two blood-red bands, and a third dusky band across the wing-covers. It is supposed by most entomologists that these insects pass the winter in the perfect state, hybernating under bark, dead leaves, and rubbish; but during the last winter a thorough search was made in the neighborhood of some grape-vines which had been very much injured by the leaf-hoppers the previous season, and no mature insects could be discovered, either under the loose bark of the grape-vine, the supporting posts, or under the leaves and loose rubbish near the vines. It therefore appears probable that some of the early broods may be produced from eggs laid by the parent insect the previous autumn, either on the stem of the vine itself or on foliage. The first perfect grape-leaf hopper this season was found in April, and had probably hybernated on the stem of the vine, under the bark, as before mentioned. The insects, as soon as hatched, commence to suck the sap of the plant, and change their skin several times before attaining their full size; and these cast-off white skins may be seen in the autumn in multitudes, adhering to the under side of the leaves, each of them with a slit down the back, through which the perfect insect has escaped.

Fig. 19.



As larvæ, or when very young, they do not possess any wings, and it is only in the adult state that the perfect wings are acquired. The leaves injured by these insects appear at first flecked and spotted with whitish marks, showing where the sap has been drawn out by the leaf-hopper. They then assume a sickly appearance, and if the insects are very numerous the foliage will finally turn brown and fall to the ground. Some varieties of vines suffer more from this pest than others, and the Clinton, Delaware, and other thin-leaved grapes are said to suffer the most. There are several other species of vine hoppers beside the *Erythroneura*, mentioned by Harris, which injure the foliage of the grape-vine, and we have found a species of *Typhlocyba*, (Fig. 20,) as destructive in Maryland and Virginia, puncturing the leaves and sucking the sap in a similar manner.

Fig. 20.



The remedies already proposed for the destruction of these insects are syringing the vines with strong tobacco-water or soap-suds. A very weak mixture of carbolic acid and water has also been recommended, but when made too strong the leaves are apt to be injured. Dusting the vines with lime, wood-ashes, lime and sulphur, is said to be beneficial, and fumigation with strong tobacco, when under glass, will destroy many of them. Mr. Saunders, of Canada, states that a lighted torch carried through a vineyard at night will destroy multitudes, as they fly to the light and are burnt. This should be repeated several times at short intervals. He also says that constant stirring the earth in the immediate vicinity of the vines in spring and autumn will probably operate to disturb the perfect insect and eggs by exposing them to the frost. As lights also attract these insects at night, if a lantern were placed immediately over a pail or tub nearly filled with water, on the surface of which a little oil had been poured, whenever the vines

were disturbed the insects would immediately fly toward the light and fall into the vessel below and perish by hundreds. The same plan would also answer if lights were placed before or on boards painted with a thick sirup, or any adhesive substance like the celebrated fly-paper.

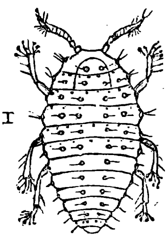
In connection with this subject of the miscalled vine-thrips, a communication has been received from Mr. Daniel Bonelli, of Saint Thomas, Lincoln County, Nevada, containing an account of some observations made by himself during the last season, on the habits of the grape-vine hoppers; and as there appears to be much difference of opinion as to whether they hybernate in the egg or perfect state, his letter may be of interest to grape-growers in general. He says: "They migrated from the vine leaves, soon after the first heavy frost in November, to the foliage of the Osage-orange hedge inclosing the vineyard, and to the adjacent rows of cottonwood, yet fresh and green. They subsisted upon these while they remained green, and then collected under the fallen leaves; and when, in December, the thermometer descended to 10° Fahrenheit, above zero, I ran water along the hedge to freeze them, and they became somewhat benumbed, but, even though frozen into the ice, came to the full use of their hopping and flying faculties immediately on being brought near fire-heat, so that the freezing-out plan was proved to be futile." He then states that, after using sulphur fumes, &c., he drove the insects, by means of water, into the shelter of raked-up leaves, and then set fire to the windrow, by which means he destroyed a great number; and adds that, by aid of fire, and an investing of every inch of soil, he hopes to reduce their numbers; and concludes that there is no doubt that they hybernate (as perfect insects) under leaves and trash in the more northern regions, and advises a deep and thorough spading under of all such leaves, &c. If our correspondent has not mistaken some other leaf-hoppers on the Osage-orange and cottonwood trees for the true vine-hoppers, this communication is very interesting, as showing that at least some, if not all, of these hybernate as perfect insects under leaves and trash; and, if so, a thorough spading up of the ground in midwinter, as formerly recommended, would destroy immense numbers.

In another part of this report it was mentioned that the common name of thrips is misapplied when used to designate the grape-leaf hopper, the true thrips being a very different insect and belonging to an entirely different family. The true thrips (Fig. 21) is very minute in size, and has a long and slender body; the wings are long, narrow, *and fringed with fine hairs;* they live on leaves, flowers, buds, and also infest grape-leaves. Almost all European authorities are unanimous in saying that they are injurious to grains, foliage, &c. Mr. Walsh states that, although hitherto considered as vegetable-feeders, they are generally, if not universally, insectiverous, and feed on the eggs of the wheat-midge and other insects. Mr. Riley also states that a species of thrips destroys the eggs of the curculio. Notwithstanding these proofs of the "cannibal" propensities of the true thrips, we are also convinced that it causes injury to several kinds of plants by draining the sap from them; as some grape-leaves, infested by the true thrips, and with no other insect on them whatever, when subjected to examination under a powerful microscope were found to have the sap exuding in minute drops or globules from numerous small punctures or holes made in the leaves, and which had evidently been made by the thrips, as some of these insects were actually employed in boring the leaves at the time, and no eggs or other insects could be discovered. It is true the thrips may possibly destroy the eggs of the vine-hopper, and of

Fig. 21.

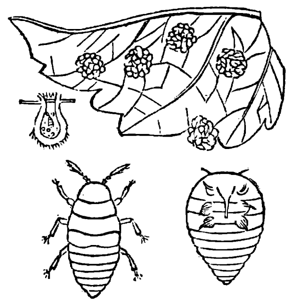
other insects also, but no doubt they also injure foliage by draining them of sap. This fact may be more plainly demonstrated by examining the plants in any green-house infested with the true thrips, where there are no vine-hoppers whatever, and the thrips-infested plants may readily be recognized by their spotted and unhealthy appearance. Some of the same remedies already proposed for the destruction of the vine-hoppers, as syringing with soap-suds, &c., would probably also answer, if applied, to destroy the true thrips.

Fig. 22.



Since the last article which appeared in the Agricultural Report for 1870, on the subject of the grape-vine leaf-gall louse, *Pemphygus vitifoliæ* (Fig. 22) of Fitch, which forms little bladder or bag-like galls on some of our native vines, and the grape-vine root-gall louse, *Phylloxera vastatrix* of Plancheron, which has done so much injury to the vineyards of France, Mr. Riley, State entomologist of Missouri, has been to France and made these insects a subject of special study, and now feels perfectly convinced that our insect is exactly the same, and has the same habits as the French insect, and that the winged specimens or migratory females, bred on the roots, accord also with the specimens brought by him from France; he also states "that the gall-louse of the leaf, and the root-inhabiting types, are absolutely undistinguishable from those hatched in the leaf-galls, and the gravid apterous female differs in no respect from the mother gall-louse. There is, however, a different egg-producing form (Fig. 23) which, as it moults, becomes tubercled and more elongated or pear-shaped. Some of these tubercled individuals remain without wings, while others acquire wings." "The insect is *found on the roots* in all stages during the summer months, and in the winter it is found dormant principally in the larva state and no eggs are to be seen, but in the spring, when the sap begins to circulate, eggs are deposited again," and the young lice produce the swellings observed on the roots. The winged lice commence to emerge from the ground as early as July, and have only two or three large eggs in their bodies, and Mr. Riley suggests that "*her whole duty in life is to consign these two or three eggs to some grape-vine or bud*, and the lice hatching from these constitute the first gall-producing mothers" that form excrescences, and lay from fifty to hundreds of eggs.

Fig. 23.



This insect sometimes attacks both roots and leaves at the same time, but Mr. Riley says that the roots appear to be less infected when the leaf-galls are abundant; and that the root-galls may be very plentiful when no galls whatever are seen upon the leaves. To give some idea of the amount of damage done by the root-inhabiting gall-louse *Phylloxera vastatrix*, in France, it is stated that the loss, in three years, amounted to no less a sum than 25,000,000 francs in the department of Vaucluse alone. The gall-inhabiting type was described in this country in 1856, but the root-inhabiting species has only lately been found. Some vines in the neighborhood of Washington have been very much infested with the leaf-gall insects, and in the grapery attached to the Department the foliage of two vines especially, the Muscat Hamburg and Grizzly Frontignac, were completely disfigured by the galls; but as yet no root-galls

have been discovered, although diligently searched for by several persons who were especially directed when and how to look for them, and to report to the Department; specimens of diseased roots were, however, sent from Ohio with the root-gall louse on them, which corresponds exactly with Mr. Riley's accurate description.

The remedy recommended for the leaf-inhabiting gall-louse is, to destroy all the leaves with the least symptoms of galls on them as soon as observed, when and wherever seen, and when the root-gall lice have taken possession of the roots they can be destroyed by immersing them in hot soap-suds or tobacco-water. It is also recommended to apply carbolic acid, added to water at the rate of one-half to one per cent. to the roots of infected vines, by pouring it into holes made with a crow-bar in the earth near the vine, when the liquid will permeate the ground, and the insects probably be destroyed. Mr. Riley gives a list of some of the principal cultivated vines affected by the leaf-gall and those injured by the root-louse, from which the following information may be gained: *The leaf-galls are most abundant* on the Clinton, Othello, (sometimes,) Wild, and Taylor, (sometimes.) There are *but few leaf-galls* on the Othello, (sometimes,) Louisiana, Alvey, Cynthiana, Herbemont, Delaware, and Creveling. *No leaf-galls* on Cunningham, Isabella, and its seedlings, Martha, Hartford, Concord, Ives, North Carolina, Maxatawney, Catawba, Diana, and Norton's seedling. *Root-lice abundant* on Taylor, (sometimes,) Othello, Cornucopia, Cynthiana, Delaware, Ives, Maxatawney, Creveling, Catawba, and Diana, and *root-lice few* on Louisiana, Wild vine, Cunningham, Herbemont, Norton's Virginia, Isabella, Hartford, Concord, (almost exempt,) and North Carolina.

An article has been lately published in many of the papers stating that Colonel Hardee, of Jacksonville, Florida, recommends as a sovereign remedy for the injuries caused by insects, to kill all the insects themselves by concussion, namely, by exploding two pounds of powder in insect-infested neighborhoods, by which means all insects in reach of the concussion of air produced by this explosion will be killed. We cannot recommend this plan, as, when destroying caterpillars by shooting or blowing them from the trees with a charge of powder discharged from a gun, we never saw any insects injured in the least that were not in a nearly direct line with the muzzle of the gun; and when cannon were fired near Washington it did not appear to have any effect whatever upon the insects in the neighborhood.

In the green-house of the Department a solution of carbolic acid has been used with good effect in destroying insects, at the rate of one and a half to two drachms of commercial carbolic acid to one gallon of water, applied with a syringe. Most of the plants appear healthy and free from *Aphides*, although it is found to be almost impossible to totally destroy them on some particular plants, except by repeated washings with whale-oil, soap-suds, or with strong tobacco-water and soap-suds.

At the end of this volume will be found a list of articles contributed to the museum of this Department, which is now in a very flourishing condition; and it may not be out of place here to remind our correspondents that any specimens weighing not more than *two pounds* can be sent to the Department for the museum free of postage; and, if of any value whatever, when received will be immediately placed in its proper division, labeled, and duly credited to the donor.

TOWNEND GLOVER,
Entomologist.

HON. FREDERICK WATTS,
Commissioner.

REPORT OF THE CHEMIST.

SIR: Within the past year the work of the laboratory has been interrupted by several changes which have occurred in this division of the Department. In the month of July, 1871, the position of chemist was left vacant by the resignation of Dr. Antisell. On the 11th of January, 1872, the present incumbent assumed that position.

As was indicated in the last report of this division, there have been collected a number of specimens of grain grown on soils of different composition, and in different climates, with various modes of culture. It is the intention to determine by analysis what difference, if any, these several circumstances have made in the composition of the grain produced. This is an important investigation, and we hope the coming season will afford us an opportunity of prosecuting it to completion; but for the present we have been induced to suspend this work, in order to answer the pressing demand for a thorough examination of commercial manures, with a view to determine their value to the farmer. The man who buys and uses manures, to maintain or increase the fertility of the soil he cultivates, should have clear and well-defined ideas of what substances constitute the chief value of the compound purchased.

A rapid sketch of those substances which contribute most to the growth of crops, will not be an inappropriate introduction to the study of manures in their analysis. If a farmer has closely watched the growth of his crops, he will hardly be at a loss to determine what element of fertility is deficient, provided he understands the part each article of plant-food plays in the process of vegetable growth. The agriculture of this country, at the present time, depends very much on the confidence which the farmers have in the liberal use of manures, and the intelligent exercise of this confidence.

Whatever diminishes the faith of farmers in the good effects of manures on their crops tends, ultimately, to diminish production, and may therefore be regarded as a public calamity. There are but few soils so favorably situated as to endure constant cropping without ultimate exhaustion. The delta of the Nile, and a few other spots similarly situated, being renovated annually by sediment from inundation, may produce successive crops without diminution for centuries; but, under ordinary circumstances, even with the most careful farming, a grain-exporting country will demand a supply of substances from beyond its own surface in order to maintain its fertility. Farmers do not always consider that in the growth of a crop nothing is created. The tons of grain, and straw, and stalk which their fields produce, are only transformations of materials which existed in other forms, either in the air or earth. It is true that the great bulk of both straw and grain is derived from carbonic acid and water—two substances of which the supply may be considered inexhaustible; but other substances, though entering into the crop in much smaller quantities, are yet absolutely indispensable. An acre of ground, producing twenty-five bushels of wheat is required to furnish forty pounds of ammonia, or its equivalent in some other available form of nitrogen, in order to perfect the grain. We make no account of the straw, for, in good farming, it is returned to the soil; but the grain is not expected to be returned in any form. From whence is the soil to obtain the ammonia to replace that sold in

the crop? Careful experiments in Europe prove that the rain-fall of the season supplies, in the form of ammonia and nitric acid, the equivalent of about ten pounds per acre of this loss. This is washed out of the atmosphere by the rain as it descends through it.

The straw of the last crop carefully plowed in will furnish, perhaps, ten pounds more; the remaining twenty pounds must be in the soil, or must be supplied from some other source. It may be furnished by stable-manure, but this is merely taking from the pasture and meadow lands to supply the grain-fields, for animals cannot create ammonia any more than plants can. They only return, in their excrement, a portion of that which was in their food. The vast freights of grain and meats, which tax our means of transportation to their utmost capacity, are great streams of the elements of fertility flowing from our fields to the towns and cities of this continent, and to the marts of the Old World, never to return again. The sewage of our cities, the wastes of our slaughter-houses, and the washings from our gas-works must be economized in the form of concentrated manures and returned to our fields in order to arrest the alarming deterioration of nearly all of our staple crops. Besides these several sources of ammonia it is quite certain that nitrogen is made available for plant-food in the form of nitric acid, which is produced under peculiar circumstances by a natural process not well understood at present. It has long been known that the earth under the floors of houses, and in other places where it is excluded from light and ventilation, soon becomes rich in the nitrates of potash and lime, if these bases exist in the soil. In the cavernous regions of Kentucky and Indiana many of the caves abound in deposits of nitrate of lime. In the stagnant air and entire absence of light are found conditions favorable to the formation of nitric acid, which, seizing on the limestone forming the walls and roof of the cavern, covers them with an efflorescence of beautiful, needle-shaped crystals of calcic nitrate. This, constantly accumulating, soon becomes too heavy to sustain its weight, and falls off, to be directly replaced by a new coat of crystals. In this manner the "saltpeter earth," as it is called, frequently accumulates to the thickness of several feet on the floor of the great caverns of that region. In the manufacture of fertilizers this saltpeter earth will be found of great value, but as yet it has attracted no attention. In a scientific point of view these saltpeter caves are of great interest. No more promising field of research presents itself to the student who would learn the mysterious operations in the laboratory of nature.

In many parts of Peru, Chili, and Bolivia sodic nitrate forms an incrustation on the surface of the ground. It is collected and sold under the name of soda saltpeter, and is extensively used in the manufacture of concentrated manures. Though plants generally contain but a small per cent. of nitrogen, yet this amount, insignificant as it appears, is a prime condition of their growth. Plants cannot use nitrogen in its uncombined form, as it exists in the atmosphere, and of the various combinations of that element there appears to be but two in which it is available as food for plants. These are the union of nitrogen with oxygen, forming nitric acid, and its combination with hydrogen in the form of ammonia. The first is generally found in the soil in combination with potash, soda, or lime, forming nitrates, and the last associated with some of the acids in the form of ammoniacal salts.

Though plants certainly do appropriate nitrogen from the nitrates which they find in the soil, yet it is a curious fact that all the proximate elements containing nitrogen, as they are found in plants, appear to be derivatives from ammonia. This has led many chemists to the conclu-

sion that ammonia is really the only available form of nitrogen in the nutrition of plants, and that nitric acid is converted into this form before it is appropriated by plants. Waiving all theoretical considerations the practical fact is that, in order to the production of a crop, the soil must contain either nitrates or ammonia, in a form capable of being dissolved in rain-water, and if this available nitrogen is not found in the soil it must be supplied by appropriate manures. Organic substances containing nitrogen always produce ammonia or nitric acid in their decay, and, therefore, an important element in the manurial value of any substance is the amount of nitrogen it contains.

Another element of plant-food, no less important than nitrogen, and even more difficult to obtain, is phosphoric acid. This indispensable element of a crop, when found in the soil, is always in combination with lime or some other base. But a neutral salt of phosphoric acid is almost entirely insoluble in water, and is, to that extent, unavailable as plant-food. Bones are familiar examples of a neutral phosphate, and every one has observed how slowly they decompose in the soil. In their fresh state one hundred pounds of bones consist of about thirty pounds of animal matter, (gelatine and oil;) and of the remaining seventy pounds, fifty-eight will represent the phosphate of lime in its neutral or insoluble form. In this condition phosphoric acid may be abundant in a soil, and yet not be available for the use of crops. The quantity of phosphoric acid necessary to produce a crop is comparatively small, but that amount must be supplied in a soluble form, or the crop fails. A crop of twenty-five bushels of wheat, taken from an acre of ground, will carry off fifteen pounds of phosphoric acid in the grain and eleven pounds in the straw. When successive crops have exhausted the soluble phosphates in a soil the land will refuse to perfect the grain, though the early growth of the crop may be in fair proportions. But if the phosphates are present in an insoluble form rest will temporarily restore the productive power of the soil by the action of natural agencies, rendering a sufficient supply of the phosphates soluble, and, consequently, available. But few soils have a large supply of phosphates, even in the insoluble form; and if grain and hay and live stock have been sold from the farm for a succession of years, and no compensation made for the phosphates thus removed, there comes a time, sooner or later, when this element of fertility will be exhausted, and the soil refuse to produce. The only exceptions to this rule will be found in those soils where the underlying rock is a decomposing limestone, abounding in the fossil remains of shell-fish, or a shell-marl, rich in the excrement or relics of marine animals. A good example of the first of these exceptions is found in the blue-grass region of Kentucky and in the fertile hills about Cincinnati, where the soils rest on the highly fossiliferous limestones of the Trenton group. Soils formed from the decomposition of these rocks will renew their stock of soluble phosphates by rest when excessive cropping has exhausted it; but soils derived from rocks containing few or no animal remains, if robbed of this indispensable element of fertility, will require that it be furnished from some other source. Rest will not restore it. The most direct, and as yet the most available, source of this supply is found in bones. But to make these immediately available they must be reduced to a powder, the finer the better. But if it is desirable to get the entire effect of bone-meal at once, it must be rendered soluble in water. This is best effected by the action of sulphuric acid, which reduces the neutral salt to the form of an acid phosphate, in which form it is readily dissolved in rain-water. It may not be amiss, in this connection, to remark that it is not good ecomony to use sulphuric acid in

sufficient quantity to render all the phosphoric acid soluble that is contained in the bone-meal used. A risk of losing much of it by heavy rains is constantly incurred when the soil holds a superabundance of soluble phosphate.

If bones or other neutral phosphates be reduced to a state of fine powder, either by grinding or by the operation of caustic alkalies, such as strong wood-ashes, &c., acting on the animal matter, the particles thus presenting an extended surface will be slowly acted on by rain-water holding carbonic acid in solution, and a sufficiency will be thus dissolved to supply the ordinary demands of a crop, if a liberal quantity of bone-meal has been used. Treated with alkalies in this form, bone-dust is not so active a fertilizer as when acted on by sulphuric acid, but the effect, even if the same quantity is used, is continued much longer.

Phosphate of lime is found as a mineral, associated with crystalline rocks and mica slate, in various parts of the world, but the supply in this form is too small to be relied on for agricultural purposes. The recent discovery of beds composed of the bones and excrement of marine animals, associated with the lias of England and with the cretaceous (?) formation of South Carolina, promises to open a new source for supplying phosphoric acid, which will be more available than bones and practically inexhaustible. These phosphates, however, are in the same neutral form as bones, and will require a similar treatment to render them available as manures. It may be well to remark that in these mineral phosphates the animal matter has chiefly disappeared, and therefore they cannot be acted on by alkalies to reduce them to powder, as bones can. Guano, from the islands off the coast of Peru, is a fruitful source from which has been supplied a vast amount of phosphoric acid to the fields, both of Europe and America; but the demand has so increased the price of guano, that a cheaper source of supply is a desideratum.

Next to phosphoric acid the most important element of fertility, and that most difficult to maintain, is potash. In all soils this is originally derived from the decomposition of crystalline rocks. Feldspar, one of the constituents of these rocks, contains potash in the proportion of sixteen pounds in every one hundred pounds of the mineral, which is equal to 24 per cent. of carbonate of potash. But this is locked up in an insoluble combination with silica, from which it is slowly liberated by the action of atmospheric agencies. This decomposition and liberation of potash can be hastened by the action of quick-lime on the silicious particles in the soil.

Formerly our dependence for potash, to supply the wastes of that element in the soil, was almost entirely on wood ashes; but, lately, a new source of potash supply has been opened by the discovery of inexhaustible beds of potassic chloride, at Stassfurt, in Prussia. At present, this is the cheapest source from which the manufacture of commercial manures can be supplied with this important element of fertility. When available for immediate use, potash is usually found in the soil in the form of a carbonate, which is very soluble in water, and liable to be lost by the effect of drenching rains. A careful attention to the preservation and use of all the wood ashes made on the farm, and the return to the soil of the residuum of all the crops produced, will usually secure a supply of potash equal to the demand of ordinary crops. The straw of wheat contains double the amount of potash found in the grain, and the stalks of a corn-crop have four times as much potash as the grain. The habit, so common on the western prairies, of removing the entire corn-crop from the ground where it grew, and leaving the wastes of the fod-

der to accumulate in feeding-lots, will soon necessitate the purchase of potash to compensate for this waste.

All fertilizers do not act directly by furnishing from their own composition the material for the growth of plants. An important class of manures operates indirectly. In this list lime is entitled to the first place in point of importance. Though lime is present in almost all forms of vegetation, yet it enters into the composition of plants in such small quantities, and is itself so largely distributed, that scarcely any soil can be found without sufficient lime to supply the demand of crops. To furnish the lime necessary for the use of growing crops cannot, therefore, explain the marked effect on crops, which is often observed to follow the use of lime. The presence of quick-lime has a tendency to hasten the decomposition of organic matter in the soil, and to bring the mineral elements to the highest state of oxidation. By the first of these influences, the elements of plant-food are liberated in full supply for the use of the growing crop; and by the second the mineral matter is made more soluble, and thus rendered available. But it must be constantly remembered that the use of lime greatly increases the expenditure of plant-food, both organic and mineral; and, unless the soil be liberally supplied with the appropriate manures, it will, in process of time, be entirely exhausted. Lime is not really a manure; it does not increase the stock of plant-food on hand, but only hastens the expenditure of that material. Land-plaster (sulphate of lime) is another indirect manure, the action of which has long been a subject of discussion among observing farmers. It furnishes sulphur and lime, both of which are needed in the growth of crops; but this is certainly not the chief office of plaster as a fertilizer, for it often proves of great benefit on soils where both of these substances abound in an available form. The action of plaster is chiefly chemical. Sulphuric acid (which, in combination with lime, forms plaster) prefers ammonia to lime, and in the presence of that substance abandons the lime, to form a new salt with ammonia. One of the great difficulties in manuring land is to retain ammonia for a full supply to the crop during the summer. It is a gas, lighter than air, and even when combined with carbonic acid (its usual form) it is exceedingly volatile. Carbon in the form of charcoal, muck, or even vegetable mold, will absorb ammonia largely, and retain it with a good degree of tenacity under ordinary circumstances. On soils abounding in carbonaceous matter, the effect of plaster is scarcely perceptible; but where this is scarce, plaster retains the ammonia that is brought to the soil either by rain-water or by the air, converting it into a sulphate. This salt is entirely involatile at ordinary temperatures, but dissolves readily in water, thus presenting this important element of plant-food in a most economical and available form. This function of plaster to reduce ammonia to a fixed form renders it an important ingredient in composting manures, provided the compost-heap is not exposed to drenching rains.

While it may be possible, by careful farming, to so economize the available nitrogen of the soil as to maintain a supply for an indefinite period, yet, on a moment's reflection, it must be evident that we cannot, under ordinary circumstances, export grain and meat from year to year without ultimately exhausting the mineral elements of the soil, or at least the phosphoric acid and the potassic salts. These must be supplied from sources beyond our own fields, at least to the amount they are contained in the produce sold. But fortunately these constitute but a very small per cent. of the weight of the products carried off. The farmer who sells one hundred bushels of wheat carries away from the soil which produced it sixty pounds of phosphoric acid and

forty-eight of potash. Now, so long as the fields which produced this wheat can, by the decomposition of the mineral matter they contain, bring into a soluble form this amount of each of these minerals, from year to year, all is well if the other conditions of a crop are in full supply. But small and apparently insignificant as this proportion of these substances seems, yet, if they are not supplied in an available form, the crop fails.

No amount of organic matter destitute of phosphoric acid and potash can compensate for this deficiency. In this relation the commercial manures of the markets are to the farmer of the very first importance. These, however, should merely supplement the products of the compost-heap, and not supersede them. On the farm, nothing can justify the neglect or waste of stable and barnyard manure. If the wastes of manure on the farms and about the villages of the country were corrected by a proper economy, the necessity of using any large amount of guano, superphosphate, or German potash might be postponed for years. The exposure of the manure-pile or compost-heap to the drenching rains of the spring months wastes the soluble salts of potash and ammonia, as well as the available phosphates, leaving the residue with little of value beyond the absorbent power of the carbonaceous matter. It would be very easy to double the value of domestic manures on most of the farms in the country, by covering the compost-heap with a heavy coat of swamp muck, or even common mold, and keeping it excluded from the rains beyond what is necessary to preserve it in a moist condition. There is also a great waste on many farms by suffering wood ashes to be exposed to heavy rains, which wash away the soluble potash and render the ashes nearly worthless.

The constantly increasing attention which the subject of manures is commanding is among the most hopeful signs for American agriculture. To encourage this tendency toward a more careful and a more rational system of farming, it is due to those who purchase manufactured manures that they be furnished with the means of knowing the value of what they buy; and it is equally due to the honest manufacturer that he be protected from the influence which the suspicion of fraud in commercial manures has on his business. Carrying out the policy of this Department, various forms of concentrated manures have been purchased as found in the market, and the work of a careful and minute analysis of them has been commenced, the result of which will be published for the benefit of the farming community. I subjoin the first installment of this work, and hope to be able to continue it as we procure other specimens in the market. Analyses made and published by the manufacturers themselves are valuable only so far as the manufacturer is honest in furnishing to the chemist the same article which he sells in the market, and the chemist is competent and honest in his work. It is proposed to publish only the analysis of such articles as are purchased in the market by a reliable and disinterested agent, and each article must bear the trade-mark of the manufacturer. By this means purchasers are furnished with a reliable standard of value; and manufacturers will have an additional incentive to furnish manures of real value.

ANALYSIS OF COMMERCIAL MANURES.

In the following tables of analysis it is the chief purpose to show the amount of available nitrogen, the quantity of phosphoric acid in its several conditions, and the proportion of potassa. The first of these we choose to represent as ammonia, because this is the usual, if not the only, form in which plants appropriate that element.

Phosphoric acid exists under three forms, to wit, soluble, insoluble, and reverted. The last-named form is often overlooked, and classed as insoluble. When phosphate of lime has been acted on by sulphuric acid, so as to reduce the phosphoric acid to such a condition that it will dissolve in pure water, if it be long kept in contact with lime or other bases, it passes into a state in which pure water will no longer dissolve it, though in this condition it is readily soluble in water holding oxalate or citrate of ammonia in solution. We have the highest authority for assuming that in this form phosphoric acid is practically as valuable as in the soluble form; we therefore estimate them together. We subjoin a table of values in currency, compiled from the latest and most reliable authorities:

Ammonia, per pound	$0 22
Phosphoric acid, soluble and reverted, per pound	0 15
Insoluble, per pound	0 05
Potassa, (as anhydrous oxide K., O.,) per pound	0 08

NITRO-PHOSPHATE OF LIME.

This fertilizer is made by the Lodi Manufacturing Company. A barrel of the nitro-phosphate was purchased at the office of the company, No. 66 Cortlandt street, New York. It consisted of two hundred and fifty pounds, a sample of which on analysis yielded:

Water, (determined at 100° C.)	3.765
Organic matter capable of yielding ammonia, 10.20	50.015
Soluble and reverted phosphoric acid	1.680
Insoluble phosphoric acid	6.870
Potassa	0.474
Silica and other inorganic matter	37.196
	100.000

A ton (2,000 pounds) contains:

Ammonia, actual and potential	204 pounds.
Soluble and reverted phosphoric acid	33.6 pounds.
Insoluble phosphoric acid	137.4 pounds.
Potassa	9.48 pounds.

Price per ton at New York, $55.

PHOSPHATIC BLOOD GUANO.

[From the Manhattan Manufacturing and Fertilizing Company.]

Of this compound one bag, containing one hundred and forty-eight pounds, was purchased at the office of the company, No. 31 Broadway, New York. After careful mixing, a sample gave—

Water, (determined at 100° C.)	6.875
Organic matter, capable of yielding ammonia, 11.74	44.765
Soluble and reverted phosphoric acid	3.248
Insoluble phosphoric acid	6.629
Potassa	0.039
Silica and other inorganic matter	38.444
	100.000

A ton contains—

Ammonia, actual and potential	234.80 pounds.
Soluble and reverted phosphoric acid	64.96 pounds.
Insoluble phosphoric acid	132.58 pounds.
Potassa	.78 pounds.

Price per ton at New York, $50.

BAUGH'S RAW-BONE SUPERPHOSPHATE OF LIME.

[Manufactured by Baugh & Son; bought of John Ralston, agent, 190 Front street New York.]

The superphosphate was well packed in a box containing fifty pounds, and was in good condition when opened. The analysis gave—

Water, (determined at 100° C.)	1.370
Organic matter, capable of forming ammonia, 1.36	30.365
Soluble and reverted phosphoric acid	7.415
Insoluble phosphoric acid	7.475
Potassa	0.434
Silica and other inorganic matter	52.941
	100.000

A ton contains—

Ammonia, actual and potential	27.20 pounds.
Soluble and reverted phosphoric acid	148.30 pounds.
Insoluble phosphoric acid	149.50 pounds.
Potassa	8.68 pounds.

Price per ton at New York, $50.

COTTON-BALE BRAND SUPERPHOSPHATE.

[Manufactured by John Ralston, New York, and bought of the manufacturer, at 190 Front street, New York.]

The superphosphate was contained in a bag said to weigh two hundred pounds; actual weight, one hundred and ninety-six pounds. The analysis gave—

Water, (determined at 100° C.)	1.370
Organic matter, capable of yielding ammonia, 4.08	27.210
Soluble and reverted phosphoric acid	5.814
Insoluble phosphoric acid	8.168
Potassa	0.481
Silica and other inorganic matter	56.957
	100.000

A ton contains—

Ammonia, actual and potential	81.60 pounds.
Soluble and reverted phosphoric acid	116.28 pounds.
Insoluble phosphoric acid	163.36 pounds.
Potassa	9.62 pounds.

Price per ton at New York, $46.

DOUBLE-REFINED POUDRETTE.

[Bought of the Lodi Manufacturing Company, at their office, No. 66 Courtlandt street, New York.]

The package (one barrel) contained two hundred and thirty-four and one-half pounds of poudrette, and reached the laboratory in good condition. The analysis shows—

Water, (determined at 100° C.)	2.815
Organic matter, capable of yielding ammonia, 2.734	25.790
Soluble and reverted phosphoric acid	0.966
Insoluble phosphoric acid	5.800
Potassa	0.000
Silica and other inorganic matter	64.229
	100.000

A ton contains—

Ammonia, actual and potential	56.68 pounds.
Soluble and reverted phosphoric acid	18.32 pounds.
Insoluble phosphoric acid	116.00 pounds.

Price per ton at New York, $25.

COE'S AMMONIATED BONE SUPERPHOSPHATE.

[Williamsburgh, New York. Bought of R. H. Allen & Co., No. 189 Water street, New York.]

One barrel, containing two hundred and fifty-six pounds. The material was put up well and arrived at the laboratory in good condition. The samples analyzed show the following composition:

Water, (determined at 100° C.)	2.910
Organic matter, capable of yielding ammonia, 3.40	41.735
Soluble and reverted phosphoric acid	3.281
Insoluble phosphoric acid	17.213
Potassa	0.935
Silica and other inorganic matter	33.926
	100.000

A ton contains—

Ammonia, actual and potential	68.00 pounds.
Soluble and reverted phosphoric acid	65.62 pounds.
Insoluble phosphoric acid	344.26 pounds.
Potassa	18.70 pounds.

Price per ton at New York, $50.

SUPERPHOSPHATE.

[Trade-mark, (W & C.) Manufactured by Watson & Clark, Philadelphia, Pennsylvania.]

A barrel of this superphosphate was bought of Vanderbilt & Bros., dealers in guano and fertilizers, No. 23 Fulton street, New York. The package was marked two hundred and fifty pounds, but the net weight at the laboratory was but two hundred and twenty-six pounds. The analysis gives—

Water, (determined at 100° C.)	3.300
Organic matter, capable of yielding ammonia, 1.36	66.935
Soluble and reverted phosphoric acid	6.588
Insoluble phosphoric acid	6.594
Potassa	a trace
Silica and other inorganic matter	16.583
	100.000

A ton contains—

Ammonia, actual and potential	27.20 pounds.
Soluble phosphoric acid	131.76 pounds.
Insoluble phosphoric acid	131.88 pounds

Price per ton in New York, $50.

MASSE'S NITROGENIZED SUPERPHOSPHATE OF LIME.

[Bought of John M. Thorburn & Co., No. 15 John street, New York.]

The package contained three hundred and twenty pounds, and arrived

at the laboratory in fair condition. The analysis shows the following composition:

Water, (determined at 100° C.)	2.125
Organic matter, capable of yielding ammonia, 4.76	34.865
Soluble and reverted phosphoric acid	6.728
Insoluble phosphoric acid	8.826
Potassa	a trace.
Silica and other inorganic matter	47.456
	100.000

A ton represents—

	Pounds.
Ammonia, actual and potential	95.20
Soluble and reverted phosphoric acid	134.56
Insoluble phosphoric acid	176.52

Price per ton in New York, $50.

ANALYSIS OF MISCELLANEOUS SUBSTANCES.

"*Cundurango.*"—The sample of the plant forwarded to the Department under the above name, by the Department of State, and accompanied by a letter from the secretary of the Smithsonian Institution, was submitted to examination and chemical analysis in this laboratory. The sample consisted of the stem and branches of what appeared to be a shrub, unaccompanied by either root or leaf, or anything by which the botanical relations of the plant could be determined. The stem is woody and covered by a greenish bark. The wood is straw-colored and brittle, and is nearly tasteless; but the bark has an aromatic, bitter taste.

The proximate analysis of the bark gives—

Moisture	8.
Mineral substance, (ash)	12.
Vegetable matter	80.
	100.

No volatile oil or acid was detected by distillation. The eighty parts of vegetable matter consisted of—

Fatty matter, soluble in ether	7.0
Yellow resin, soluble in alcohol	2.7
Gum and starch	0.5
Tannin, with a yellow and brown coloring matter	12.6
Woody fiber	63.5
	80.0

No alkaloid or active principle was detected, on which its reputation as a cancer-cure rests. Its therapeutic place is with aromatic bitters.

TUCKAHOE, OR INDIAN BREAD.

This curious fungus (*Scleroticum giganteum*) is quite common in many parts of the Southern States, where it is frequently used as an article of food. To determine its nutritive value a specimen from Columbia, Virginia, was subjected to careful analysis in this laboratory, with the following results;

Moisture	14.16
Glucose, (fruit sugar)	.93
Gum	2.60
Pectose	17.34
Nitrogen in an insoluble combination	0.36
Woody fiber	64.45
Ash	0.16
	100.00

This analysis does not sustain the high reputation of this substance as a food material.

VIRGINIA SUMAC.

Two specimens of sumac-leaves grown in Virginia were tested by Miller's method, to determine the amount of tannin they contained, with a view to the substitution of American in the place of foreign sumac in the manufacture of fine leather.

No. 1 gave of tannin	19.3 per cent.
No. 2 gave of tannin	17.4 per cent.

ILEX CASSINA, OR CAROLINA TEA.

Preliminary analysis.

The dried leaves of the plant, treated with the usual solvents, yielded the following result:

Soluble in ether	6.96
Soluble in alcohol	4.84
Soluble in cold water	8.24
Soluble in both alcohol and water	10.15
Soluble in hot water with 5 per cent. hydrochloric acid	15.28
Insoluble	46.93
Moisture expelled at 120° C	7.60
	100.00

Proximate analysis gave—

Volatile oil	0.011
Wax and fatty matter	0.466
Resin	3.404
Chlorophyl	2.491
Caffeine	0.122
Tannic acid	2.409
Coloring matter soluble in alcohol	4.844
Extractive matter insoluble in alcohol	8.244
Starch and pectose	15.277
Extractive matter soluble in alcohol	10.149
Nitrogenous matter insoluble in water	8.138
Woody fiber	33.824
Moisture	7.595
Ash	3.935
	100.909

The redundancy is probably moisture absorbed.

ASHES FROM SPENT TAN-BARK.

Potassa soluble in hot water	12.05
Lime	4.41
Magnesia	.22
Iron	a trace
Silica and insoluble silicate of potassa	83.35
	100.00

ANALYSIS OF SOILS.

In the early days of agricultural science much was anticipated from the services which chemistry would be able to render in the way of determining accurately the several substances used in the growth of crops, and the proportion of each of these in the different kinds of crops. Having made these several determinations, nothing more would be necessary than to ascertain what element of plant-food is deficient in the soil, and supply it accordingly. This appears so simple, and, at the same time, so plausible, that it is not surprising that there should arise almost a mania for soil-analysis among progressive farmers. But unforeseen difficulties arose, and these ardent anticipations were doomed to disappointment; and the value of soil-analysis is now in danger of being as much undervalued as it was formerly overestimated.

The first and chief difficulty in the way of profitable soil-analysis is the great diversity and inconstant character of soils. We may take samples of soils from several places on the same acre of ground, and analysis will show that each is different from the others, so that a single sample taken for analysis would be of no value, and indeed might mislead the farmer in the proper improvement of his soil. In relation to several important elements of fertility the composition of the soil is very far from being constant.

Ammonia is one of the most important elements of plant-food, but it is exceedingly volatile; and if we examine a soil when it is first broken for a spring crop, and repeat the examination after the field has been exposed to the heat of the summer months, we shall find that the ammonia of the soil has diminished one-half or more, under the influence of summer heat. On the other hand the soluble salts of potash, soda, lime, &c., will accumulate under the influence of dry, hot weather; but if the drenching rains of spring are suffered to wash the soil, these soluble salts will proportionately diminish. It will be readily perceived that an accurate analysis of the same soil at different seasons of the year will show very different results. Of the materials which go to make up the bulk of field-crops, so small a proportion is derived from the soil that it renders the process of determining the presence of that little a very delicate one. If two hundred pounds of guano be carefully mixed with the soil of an acre of ground, its effect on the crop will be very sensibly perceived; but of the essential elements of plant-food, the guano has added to the soil only six pounds of potash, twenty-four of phosphoric acid, and thirty-four of ammonia. But if the soil be cultivated to the depth of eight inches only, these several quantities will be mixed with about three million pounds of earth. It is unnecessary to say that by the ordinary process of operating on two or three pounds, though the presence of any one of these elements of plant-food could be determined, perhaps, yet its quantity could not be ascertained by the most delicate balances in use. Growing vegetables often collect from the soil appreciable quantities of substances, which the most rigid scrutiny fails to find in it. The salts of rubidium are found in the beet-root and in the tobacco-plant, but even the spectroscope fails to detect it in the soils where these grew.

But we are not to conclude from this that the farmer cannot profit by a knowledge of the composition of his soil. This knowledge, however, relates as much to the mechanical condition of the soil as to its chemical composition. If the particles composing a soil are in a state of very fine division, it will be much more productive than a coarse soil of the same chemical composition. That property of a soil which

enables it most readily to absorb gases from the air, and most tenaciously to retain them, is always to be considered a leading feature in its fertility. Uncombined carbon, as it exists in the residue of vegetable and animal decomposition, possesses this property in a higher degree than any other known substance; hence the amount of organic substance in a soil becomes the measure of this element of fertility. This determination can be readily and accurately made, and is indeed one of the most important in soil analysis.

The power of a soil to absorb and retain moisture is an important feature in regard to its productiveness. This appears to be intimately related to the amount of water it is able to hold below saturation; and both these properties can be determined by any one who has at command an accurate balance. These properties, together with the facility of percolation and the activity of capillary action, depend largely on the firmness of the particles composing the soil. The proportion of clay in a soil has usually been regarded as the measure of these several properties of a soil in relation to water. This is true only so far as clay is not suffered to become saturated with water, so as to cohere and form a compact mass. In this condition it loses most of its absorbent power.

The relation of soils to heat is a subject which is too often overlooked in soil analysis. Investigations in this direction can be best prosecuted in a field under cultivation. Several thermometers should be used at the same time in different parts of the field in exposures as nearly alike as possible, so as to determine the rate at which each quality of soil acquires heat as the day advances. In a similar manner the loss of heat in the evening can be determined. These, and kindred investigations, can be conducted by the farmer himself, with but little knowledge of science. If a farmer carefully observes the growth of his crops, he will need but the application of a few general principles to lead him to the proper improvement of his soil. If with a good sun-exposure his crops wear a pale green, he may fairly infer that there is a deficiency of available nitrogen in the soil. If the straw of his grain is soft and too weak to bear the head, he may learn that there is too little potash in his soil. Or if there is habitually a good growth of straw, with but a small amount of grain, let him resort to phosphates for a remedy. A little careful observation of his soil, and the manner in which his crops grow on it, will teach the intelligent farmer more important practical lessons in the management of his farm than he will be able to learn from the most exhaustive analysis.

RYLAND T. BROWN,
Chemist.

HON. FREDERICK WATTS,
Commissioner.

REPORT OF THE SUPERINTENDENT OF GARDENS AND GROUNDS.

SIR: I have the honor to submit the following report on the operations of the division under my charge:

The improvements on the grounds of the Department are progressing as rapidly as available means will permit; so much labor as can be spared from the routine of keeping the grounds and the trees in proper condition is employed in permanent improvements, which are now well advanced toward completion. The trees have progressed favorably, and many of them have reached dimensions that indicate their true characteristics of growth. The policy of surrounding the arboretum with such species as make rapid growth and are perfectly hardy is now being realized in the shelter thus afforded the more tender species in the interior. The landscape or artistic effect is also developing, although several years must elapse before this feature becomes strongly marked.

The appropriation allowed for the erection of the conservatory not being sufficient to complete all the details, one of the apartments has not yet been provided with apparatus for heating, consequently is not yet in use as a plant-house. The amount required to complete the whole will not exceed the originally submitted estimate of total cost. The structure is well arranged and adapted to the purposes for which it is used, and the additions that are being made to the collection of exotic plants will soon make it one of the most complete in its special line.

The system of exchanges of native plants and seeds for similar products of foreign institutions, which was commenced some years ago, is now proving of great value in enabling the Department to secure plants that are rarely to be found for sale in commercial establishments, and which are to be procured only from leading botanical and governmental gardens; all of which cheerfully respond to this system of mutual exchange of products.

The Department is also indebted to representatives of the Government who are stationed in foreign countries for seeds and living plants of species that could not otherwise be obtained. With few exceptions these representatives have promptly responded to inquiries relating to vegetable productions, and have exerted themselves to fulfill the wishes of the Department, both in the introduction of new plants of value and interest and in furnishing useful information relative to cultivation and other matters of special importance.

The exotic grapery was planted with ninety varieties of the *Vitis vinifera*. Among these are several new kinds, which have not yet fruited in this country and which may prove valuable for vineyard culture on the Pacific coast. Although planted late in the season, owing to the difficulty of collecting so great a number of kinds, the plants made very satisfactory growth and matured canes of sufficient strength to carry fruit the coming year, thus affording an early opportunity of correcting any errors that may occur in their nomenclature. It is proposed to prune and train these vines on what may be termed the *renewed terminal cane* system, which is now being fairly tested on the trellis of native grapes, and which will undoubtedly become general whenever its merits are clearly understood.

ORANGE HOUSE.

Efforts have repeatedly been made by the Department to secure a complete collection of the genus *Citrus*, but so far with but limited success. Arrangements have again been made with collectors in Europe

which will, in all probability, secure all the species and varieties of this family.

The collection now numbers about fifty kinds, but the propagation and distribution have been almost solely confined to the Maltese oval, the true Saint Michael's, and the Tangerine oranges, of which several hundred plants, grafted on healthy stocks, have been sent to the Southern and the Pacific States.

The propagation of various species of *Cinchona*, of *Eucalyptus globulus*, and of *Phormium tenax*, has received special attention during the year. Many applications have been received from all parts of the country for cinchona and eucalyptus plants, for the purpose, as applicants state, of testing the adaptability of the plants to their respective locations and climates. The writers of these applications do not seem to regard the well-known laws that regulate the geographical distribution of plants, or their own inability to secure the climatic conditions essential to successful culture. A climate suited to the growth of cinchona may be found in Southern California; certainly there is but slight hopes of this plant flourishing to any valuable extent in any other region of the States. Some few returns from Florida show partial success by protection in winter, but this proviso will prevent any attempt to a commercial success, entire exemption from frosts being an indispensable climatic qualification in so northern a latitude as is embraced in even the most southern sections of this country. Numerous schemes have also been presented by individuals and companies for the establishment of cinchona plantations. All of these schemes require a grant of more or less Government lands, and also that the Government furnish the plants for the test. If the cinchona should prove a failure it is suggested that the lands could be used for testing other crops, at the expense and for the profit of the country. None of these generous offers have yet been accepted by the Government, but as soon as arrangements can be made in any direction that seem to include elements of success, the Department can at any time furnish several hundred plants, or a sufficient number to allow a fair test of culture and adaptability of climate; but the Department cannot afford to send plants except where these conditions seem probable.

The *Eucalyptus globulus* will endure a colder climate than will the cinchona; but even this plant will not stand many degrees of frost without injury, and is altogether unsuited for our western plains, where its rapid growth would make it a valuable addition to the list of available forest trees. Attempts to climatize this plant on the dry prairies of the West will be futile on account of the severity of the winter colds. Its medical qualities are said to be of great value; but this point has not yet attracted the attention of our pharmaceutists, although much is stated as to its value in European medicine. If on examination it prove worthy of attention its culture can be rapidly extended, and plants can now be furnished by the Department in sufficient quantities for trial.

The New Zealand flax, *Phormium tenax*, can also be rapidly increased, now that a stock has been procured for propagation; the strong fiber contained in the leaves of this plant would seem to warrant chemists and manufacturers in turning attention toward its profitable separation and utilization; when this is fully accomplished, the culture of the plant can be encouraged and increased to any desired extent.

DWARF PEARS IN GRASS.

A small orchard of dwarf pears, which was planted during the spring of 1865, after growing very luxuriantly for three years, during which

time the soil was kept cultivated and clear of weeds, was sown with grass and clover-seeds in the spring of 1869, with the purpose in view of slightly repressing the heavy annual growths which were produced by nearly all the varieties. The grass has been mowed several times during each season. The trees have not received any pruning or shortening of the points of branches either in summer or winter, although entire branches have been removed from those that became overcrowded.

They have been very productive, and have ripened several heavy crops of fruit, and continue to show evidence of prolonged prosperity. At the time of sowing the surface in grass it was not proposed to allow it to remain longer than two or three years in sod; but the health, productiveness, and general vigor of the trees are such that cultivation or stimulants of any kind are not yet necessary, and until the trees show such necessity the surface will remain undisturbed.

HOT-WATER HEATING.

In laying iron piping for the purpose of heating green-houses by the circulation of hot water the idea has somehow become quite prevalent that, in order to secure a proper flow of water, it is necessary to incline the pipes for some distance from the boiler. In other words, the flow-pipes are laid on an ascending grade and the return-pipes on a descending grade. There is no rule or uniformity as to either the extent of the ascent or the distance to which the ascending pipes are carried. These conditions are generally regulated by the length of the house; it may be 20 or 200 feet in length; in either case it is considered necessary that the flow-pipes should rise until the length of the house is reached; then the water is conducted in a descending grade to the boiler.

The fact that the point at which the downward flow commences is not fixed by any rule, shows very conclusively that neither the length of the ascending pipe nor the height to which it reaches is essential in the abstract question of the circulation of the water, but is merely a matter of fancy or convenience in the mechanical arrangement of the pipes.

Pipes arranged in the above manner usually work very well if laid in straight lines having but few bends or turns, and even with these the heated water will gradually circulate throughout the whole; but it is very doubtful if there is a single advantage gained in having the water circulate in ascending pipes, which requires more force and involves a waste of time on account of friction on the sides of the pipes; and experiments prove that there are disadvantages connected with it, which, although but slight in many cases, yet in others have been found sufficient to cause an imperfect circulation, which has been remedied by altering the pipes so as to take advantage of gravitation.

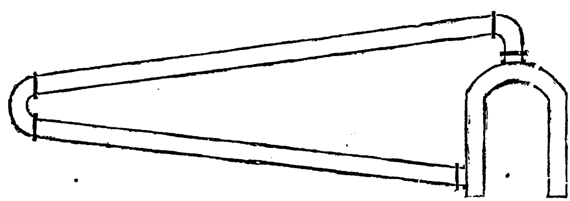
But it appears that many persons are of the opinion that it is an absolute necessity to lay the flow-pipes on an ascending grade, and in consequence it frequently happens, in order to meet this supposed necessity, that heavy expenses are incurred in sinking and draining deep stock-holes for the reception of the boiler. It is, therefore, important to know that the efficient working of the apparatus does not depend upon having the pipes laid on an ascent; but that, other things being equal, the most rapid circulation is secured when the top of the boiler is the highest point in the whole arrangement, and all the pipes are descending from that point until they reach the bottom of the boiler.

Theoretically it seems plausible that this mode of laying the piping should act in the most perfect manner, as the water has the advantage

of gravitation to assist its movement through the pipes, and thus overcome, in the best possible way, the retarding effect of friction on the sides of the pipes. The fact that the heat is conveyed by the circulation of the water affords a good reason for the slower movement in an ascending pipe, as compared with the more rapid flow when the course of the water is on a downward slope, and the movement assisted by gravitation, in addition to the force procured by the difference in density between the highest and the lowest points of communication with the boiler.

If the water absorbed and transmitted heat by conduction only, then the position of the pipes would be but of little importance; but as it is by convection, circulation, or actual movement of the water, then gravitation and diminished friction are notably influential in the efficient working of the apparatus.

The following sketch indicates the arrangement of a boiler and piping that will operate to the best advantage:



MINOR VEGETABLE PRODUCTS.

The increased attention which is now being given to diversified culture, especially in the Southern States, is apparent from the many inquiries reaching the Department concerning the culture of various minor products which are now wholly imported and which can be produced here in great perfection, as far as climates and soils are concerned. Of these the following have been selected, and their culture and management briefly noted:

Rhubarb.—The exact species of *Rheum* which yields the best medicinal rhubarb is not known with anything like certainty. What is known in commerce as the best Turkey rhubarb in reality comes from China, through Russia, and having, at one time, been imported chiefly from Natolia, it received the name of Turkey rhubarb. The most highly valued medicinal rhubarb is supposed to be produced by the roots of the *Rheum palmatum.* Indian rhubarb is furnished by *Rheum E modi* and *Rheum webbianum.* In Britain, the roots of the common garden species, *Rheum rhaponticum*, are grown to a considerable extent for medicinal purposes, and it is held that there is but little difference in the medicinal effects of the English-grown root and that received from Asia. It is, however, chiefly used to adulterate the more highly-priced kinds. It is of a light, spongy texture; its taste is astringent and mucilaginous, but destitute of the aromatic and gritty qualities of the more highly esteemed sorts.

The best rhubarb has a bitter, astringent, and somewhat aromatic taste, and feels gritty to the teeth, owing to the abundance of small crystals of oxalate of lime which are contained in it. It has a very del-

icate odor, and is covered with a fine yellow powder, and the pieces when broken present a mottled, red, and yellow color, owing to the passage of a number of wavy, carmine-colored streaks through the yellowish-white matrix. Here and there are small spots of a darker color.

It is considered probable, by those who have investigated the subject, that much of appearance and supposed difference in quality is owing to the manner and care of drying the root and preparing it for market. The main point is to prevent moldiness during the drying process. The roots are taken up in early autumn, the small fibers trimmed off, and the soil and other impurities removed by washing; they are allowed to dry for a day or two in the sun, and are then cut in slices, and after exposure to the sun for four or five days, during which time they must be turned over several times daily, a hole is bored in each slice and strung on a thread, until sufficiently dry. They are then put through a finishing process by being placed in a close cylinder, where they are subjected to abrasion by the rapid revolution of the vessel; this smooths their surfaces, liberating at the same time a fine dust or powder which envelops each piece with a fine bloom, like that upon the surface of a ripe plum. But the drying process may be completed in a few hours, if treated by some of the many expeditious modes now employed in drying fruits, which would insure against danger from moldiness, and also prevent loss of flavor and color, casualties frequently attending the curing of the root when dependent upon sun-heat alone.

So far as relates to climate and soil, there is no reason why all the medicinal rhubarb required in this country may not be produced here; from $35,000 to $50,000 worth is annually imported; and as to quality, there is strong evidence to show that when the roots are produced of sufficient size in the warm soils of the Southern States they will equal the best of those from China.

One indispensable preliminary to the successful production of root crops, such as the rhubarb, is deep preparation of the soil; without the aid of the subsoil-plow its profitable culture will be extremely problematical. Plowing deeply with a common plow, the subsoiler should follow in each furrow, breaking and loosening the under strata to a depth, at least, of eighteen inches from the surface; and to insure thoroughness in the work, the process should be repeated in lines at right angles to the first; and before the last plowing, manure should be applied, as the plant will not be a profitable one on poor soils.

In order to start a plantation from seed, the plants should be grown in nursery rows the first year, and transplanted to their permanent location when one year old. The nursery ground should be put in good condition by manure and deep culture, and the seed sown in early spring, thinly, in rows, similar to the mode adopted for raising peas. When the plants appear, they should be thinned so as to allow each remaining root from three to four inches of space, which will enable them to form roots fitted for removal the spring following, if properly weeded or cultivated during the summer.

In order to allow ample space for growth, and facilitate cultivation, the plants should be set out in rows four feet apart and at least three feet between the plants in the lines. The routine of treatment will consist of frequent deep stirring of the soil between the plants, a small subsoil plow being the most efficient implement for this purpose. Late in autumn, just previous to the freezing of the surface soil, a light furrow may be thrown over the crowns or buds of the plants, forming a ridge to prevent lodgment of water directly on the plants. In spring this ridge will be smoothed down by a blunt, short-toothed harrow, so as to

avoid lacerating the young swelling buds. An application of guano in spring, sown broadcast, at the rate of three hundred pounds to the acre, will produce a marked effect in growth. The roots will be large enough for removal at the end of four years' growth, although it is a general supposition that a further growth of two to four years increases their medical value. Experiment alone can decide this, as well as other points connected with its growth and preparation.

Ginger.—The ginger plant (*Zinziber officinale*) is cultivated both in the East and West Indies to a great extent, also largely in China and Africa. It has a perennial root, which creeps and increases near the surface of the ground in tuberous joints, from each of which a green reed-like stock is produced, in spring growing to a height of three feet, with narrow, lanceolate leaves; the flowers are carried on cone-shaped spikes, thrown up from the root-stock and protected by bracts.

There is but little doubt about the practicability of growing ginger in the most southern States. Although a tropical plant, its annual growth is completed in a few months, and the roots can be lifted and stored for use or for future planting. Its management is very similar to that required for the culture of the common potato. The rhizomes may be planted in shallow drills made with a plow, covered with three inches of soil, the rows being sufficiently wide apart to admit of further culture with the horse-cultivator or hoe-harrow. A sandy soil will be more congenial to the spreading surface growth of the rhizomes, or races, as they are termed in commerce, than a clayey or heavy loam.

The ginger of commerce is distinguished into black and white, but the difference of color depends upon the mode of preparation. It is, however, supposed that there are two varieties, one producing darker roots than the other, this difference of color being independent of any mode of preparation.

When the tubers are ripe, which is indicated by the leaves turning yellow and the withering of the stalks, they are lifted out of the soil, cleaned, scraped, and dried in the sun, and in this state form the uncoated or white ginger of commerce. For black, or coated ginger, the roots are not scraped, and have a dirty appearance; sometimes they are scalded in boiling water and dried in the sun.

The best roots are selected for scraping and cleaning, therefore white ginger, independent of the manner of preparation, is superior to the black, and is usually higher priced; the black or darker tubers are sometimes bleached by exposure to the fumes of chloride of lime or burning sulphur.

The delicious conserve known as "preserved ginger" is largely exported from China, but that exported from the West Indies is of much superior quality. To prepare this article the roots are lifted before maturity, and when the stalks are from twelve to eighteen inches long, so that they are soft and succulent, they are first scalded in hot water, washed in cold, and the outer skin carefully removed by peeling; they are then put in jars and covered with a weak sirup of sugar, which is removed after a few days and replaced by a stronger; this shifting is sometimes repeated several times, the strength of the sirup being increased each time. The preserve thus made is of the best quality, and the removed sirups are utilized in the manufacture of various fermented beverages.

Ginger, when broken across, shows a number of little fibers imbedded in floury tissue. Its well-known hot, pungent taste is due to the presence of a volatile oil, and it contains a quantity of starchy, yellow coloring matter, inclosed in large cells. The ground ginger is frequently

adulterated with sago-meal, potato-flour, wheat-flour, ground rice, cayenne pepper, mustard-husks, and turmeric powder, blended in various proportions.

Preserved ginger being prepared from the soft, immature roots, renders its culture practicable as far north as Virginia, so far as climate may permit its profitable production.

Chiccory.—The chiccory (*Cichorium intybus*) is a native of Europe, where it is found growing by roadsides and in waste places, particularly in calcareous soils. It has also become plentiful in this country, and in many places is a troublesome weed. It has a long fleshy tap-root which is dried and used as coffee, and its lower spreading leaves are blanched and used as salad.

The use of the ground root as a substitute for or as an admixture in coffee is very extensive, and while it is condemned by some as being entirely destitute of those properties which render coffee an agreeable and nutritive beverage, and as containing medicinal properties which render it unwholesome for constant use, others maintain that it is one of the most harmless substances that has ever been used for the adulteration of coffee, and that the combination of a little chiccory gives it a richness of flavor, which many persons prefer to the pure article, when mixed at the rate of two ounces of pure chiccory to a pound of coffee. It is also stated that much of the ground chiccory of commerce is largely adulterated with carrot, mangel-wurzel, oak-bark, tan, mahogany saw-dust, and Venetian-red, materials which cannot be supposed to add to its value as a beverage.

There are several varieties of chiccory; that known as coffee-chiccory, the *chicorée à café* of the French, is most esteemed for mixing with coffee. It has long, fleshy roots like a carrot, and is cultivated in a similar manner. The ground being deeply plowed, in order that the long tap-roots may meet with no impediment in their downward progress, and the surface harrowed and finely divided, the seeds are sown early in the spring, thinly, in shallow drills about thirty inches apart, and when the young plants have made their appearance they are thinned out so as to leave them at a distance of ten inches apart. Proper attention having been given to weeding and cultivating during summer, the roots will be ready for removal by November, by which time the larger leaves will have decayed, leaving only a few small ones in the centers or hearts of the plants.

The best crops have been secured on rather sandy soils fertilized with guano. After the roots are taken out of the soil they are partially dried, washed, cut into slices, and thoroughly dried by artificial heat; they are then ready for the manufacturer, who roasts and grinds them for use. In order to save seed, a few plants may be left undisturbed through the winter. They will flower during summer, and ripen their seed early in the fall. The roots that have seeded are of little value, as they will become hard and woody after the second year's growth.

Chiccory leaves are largely used as a salad, especially in France, where the delicate blanched leaves are known as *Barbe de Capucin.* These are procured by placing the roots in sand, in a warm, dark cellar, where new leaves are produced perfectly colorless and tender.

Another popular mode, especially on board of ship during long voyages, consists in boring holes in a barrel or cask, in rows four inches apart, and filling it up with alternate layers of sand and roots, with the tops of the plants protruding through the holes. The barrel being placed in darkness and warmth, the plants make new leaves, affording a lasting supply of the most delicate material for salad.

Chiccory is also cultivated for its herbage as food for cattle and other live stock. On poor, sandy lands, sown broadcast like clover, it is said to produce more sheep-food than ony other plant in cultivation. Cattle eat it in France, and hogs thrive on the roots.

Licorice.—The Spanish licorice is furnished by *Glycyrrhiza glabra*, a perennial plant, native of the south of Europe. *G. echinata* furnishes a similar preparation, and is grown in Italy to some extent for this purpose. The former species is considered the most valuable; it is a hardy herbaceous plant, rooting deeply in good soils, and sending up slender branches, with pinnate leaves, and bearing blue, pea-shaped blossoms; the whole plant having very much the appearance of a vetch or wild pea.

Licorice requires a deep soil, and grows to the best advantage in light alluvial or sandy loams. The roots spread and run thickly in the soil, but unless it is deeply worked by subsoiling and made rich with manures, if not naturally in good condition, the plants will suffer during our dry, warm summers, become diseased or weakened, and preyed upon by insects, being particularly liable to the attacks of the red spider, (*Acarus telarius.*)

The plant is usually propagated by portions of the creeping stems or roots; pieces from six to eight inches in length are planted about eighteen inches apart in shallow drills, covered with three inches of soil. The rows should not be less than three feet apart, so as to admit the horse-hoe or cultivator to run between the plants; frequent loosening of the soil being of the greatest moment, and without which the plants will cease to grow during the dry seasons.

As winter approaches the stems will become yellow, and may be removed by cutting with a scythe. If young plants are required for a new plantation, they can be procured at this time, by forking up the spreading stems near the surface, and preserving them in sand for spring planting.

At the end of the third summer's growth, if the culture has been favorable, the roots will have become strong enough for economic use. The process of digging out and harvesting the roots is the most tedious operation connected with the crop. They will be found from two to three feet in depth, and can only be reached by the use of the spade and mattock, although these can be largely assisted by the plow, especially if a deep-set subsoil-plow is run close to the rows, which, by loosening the soil, may enable the operator to pull the plants up without much loss of root by breakage.

The marketable portions are trimmed of all side roots, washed, dried, and tied up in bundles. If kept for any length of time they should be covered with sand until wanted for use. The side roots are used for further plantings, and should also be suitably stored, so as to prevent them from molding, which they are very apt to do if kept warm and damp.

To raise young plants from seed, a properly enriched and pulverized spot of ground should be selected, and the small beans sown thinly in shallow drills early in spring. In rich soil, and under the most favorable conditions of growth, the young plants will be strong enough for removal after one year's growth; but a second year's growth in the nursery rows will afford better root-cuttings, as well as furnish a larger amount for selection.

WILLIAM SAUNDERS,
Superintendent.

HON. FRED. WATTS,
Commissioner.

REPORT ON FUNGOID DISEASES OF PLANTS.

SIR: The following experiments were made with the view of ascertaining what influences native mildewed vine-leaves have in communicating their fungoid diseases to the healthy parts of an affected leaf; and also of learning whether the fungus *Botrytis vitis viticola* (Berk & Curts) can be communicated by the contact of a mildewed vine-leaf with a healthy leaf growing on the same vine.

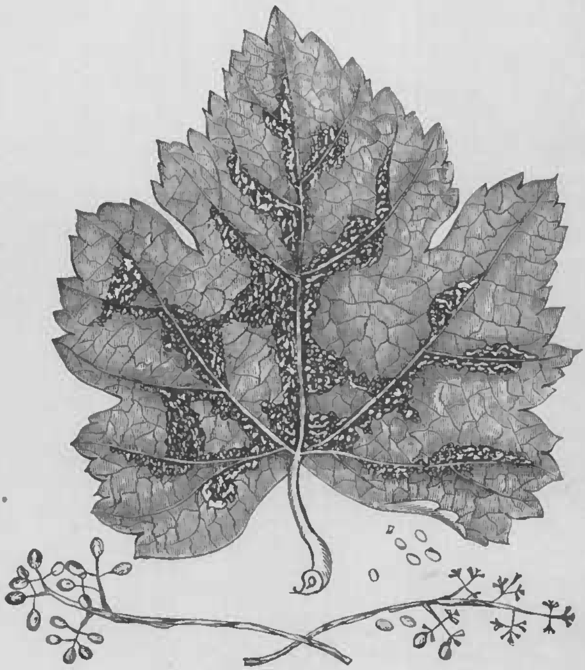
The importance of such an inquiry may be understood when we consider the relation of foliage to root, wood, and fruit growth, since the greater the leaf growth, the greater will be the root and wood growth. If mildew on the vine-leaf is infectious by contact, it follows that all affected leaves should be removed and destroyed as soon as discovered. But if, on the contrary, mildewed leaves do not communicate this disease by contact, such leaves need not be removed; and, although the disease may apparently increase and cover the entire foliage, the fruit may mature better and more quickly with mildewed leaves than without them. My experiments were confined to a Devereux vine, growing on the south part of the Department grounds. This vine was a cutting, which had been removed from its parent stock three years ago, and planted with others. I am not aware how this vine was affected during the second year of its growth, but during its third it was very much covered by the fungus *B. v. viticola*, which grows on the under side of the native vine-leaves, and is represented by Plate 1. It generally appears first along the main leaf-ribs and leading fine veins, from which it spreads over the leaves of the vine.

My first experiment consisted in securing to the back of a healthy leaf a mildewed one, its spores coming in contact with the back surface of the healthy leaf, both remaining attached to the growing vine. The second experiment consisted in securing the mildewed portion of a vine-leaf to a healthy portion of itself, doubling the leaf backward, without injury to it, and securing it in position by means of pins, the leaf remaining attached to the vine. The third experiment consisted, first, in producing by friction a slight abrasion on the under surface of the healthy portion of a mildewed leaf, and in bending back the mildewed portion, fastening it to itself in that position. The fourth, in making a slight abrasion on the upper and under surface of a healthy leaf, and in rubbing its upper and under surface with a leaf covered with spores. I visited the vine every day during eight weeks, but failed to discover any fungoid growth induced by either of the modes employed. These experiments give evidence that this species of fungi is not readily propagated by spore contact. During the experiments the weather was highly favorable to the growth of fungi, and other leaves on the same vine became mildewed during the experiments.

I find that all the leaves which were affected by this fungus were of the second growth, and of a light-green or yellowish-green color. The leaves which were not affected were of a dark-green color and of the first growth, and were consequently more matured, containing less acid. I find that all the leaves of the native varieties of a light-green or yellowish-green color, when of a soft, porous texture, are more liable to attacks of fungi on the under side of the vine than leaves of a dark color, but when these light-green leaves are thin and glossy the liability to mildew is diminished. The Scuppernong, and other varieties of this class, having glossy leaves, are said to be exempt from mildew. Their varnished surfaces probably protect them from climatic changes.

PLATE IV.

[PLATE 1 OF FUNGOID SERIES.]

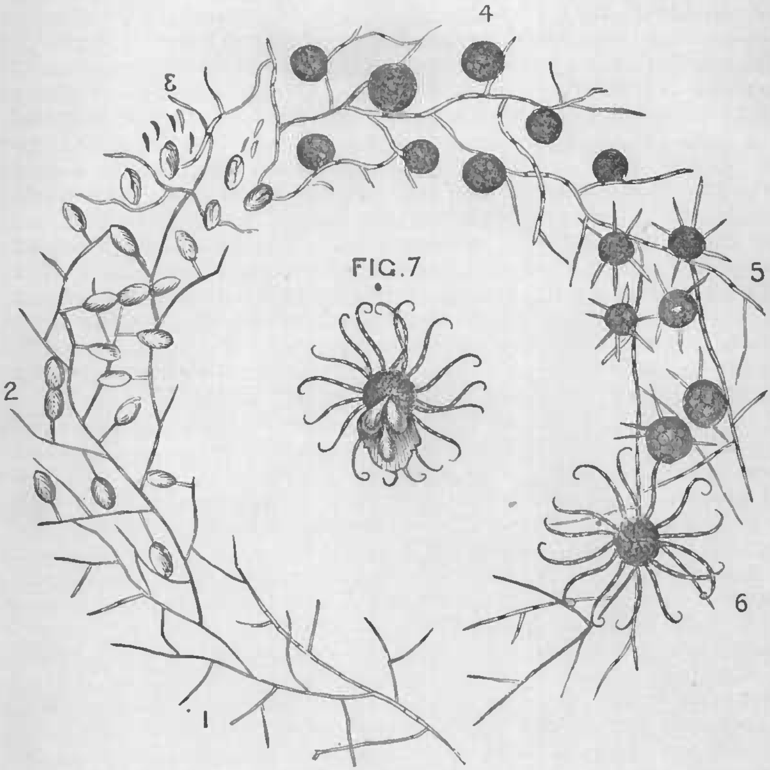


FUNGUS OF THE NATIVE GRAPE VINE.

(*Botrytus viticola.*)

PLATE V.

(PLATE 2 OF FUNGOID SERIES.)



GENUS UNCINULA.

Fungus found on the upper surface of the native grape vine in the autumn. Figs. 1, 2, 3, 4, 5, 6, and 7 represent its stages consecutively, in the latter bursting and throwing out its sporangia.

I observe that the old, dark-green leaves of the native varieties are attacked in the fall of the year by a fungus, which appears on the upper surface in white spots, and is found, when placed under the microscope, to be a species of *Uncinula*, (see Plate 2,) a form similar to *Oidium Tuckeri*, the European vine-fungus. In a plot of two-year-old vines, growing in the southeastern portion of the Department grounds, the vines generally attacked by *B. v. viticola* are easily distinguished at a considerable distance by their color, the dark-green leaves being wholly free, while the very light-green and yellowish-green, excepting thin and glossy leaves, are much affected. For example, in a row of two year old Concord vines, six hundred in number, the leaves a dark green, no fungus appeared on the leaves, while near the Concord, in a row of Herbemont vines, numbering about four hundred, every one was affected with fungus. A row of Baldwin's Lenoir had only light-green leaves affected, the older dark-green leaves being wholly exempt. A row of several hundred plants of Norton's Virginia seedling were all affected, while a row of the Clinton, the leaves of which are smooth and slightly glossy, though of a light-green color, were wholly exempt from fungi. These observations indicate the importance of fostering the leaves of the first growth, since they escape the ravages of B. *vitis viticola* during the heat of the summer. Hybrids of the European and native American vines were not so critically examined as to the effect of fungi on the leaves of the spring and summer growth, although it is well known that these vines are affected by the native fungi when grown outdoors without protection. I found, on the 23d of August, on three year old vines especially, a few leaves of the following varieties slightly attacked by *Uncinula*, viz, Rogers, Nos. 4, 5, 7, 9, 12, 13, 15, 18, 19, 20, 33, 43, 44, Cornucopia, Ives, Perkins, Rachel, Union Village, Brandt; and To Kalon had both forms of fungi on the leaves. The first growth of spring leaves had *Uncinula* on the upper side; the second growth, or summer leaves, had *B. v. viticola* on the under side.

The following list of vines of the same age, growing on the same soil, side by side with the preceding, exhibit no mildew whatever at the same date: Autuchon, Isabella, Concord, Nonantum, Rogers's 34, Clinton, Weehawken, Fedora, Creveling, Hyde's Eliza, Loudon's Early, Ives's, Alvey, Christiana, Walter, and Paxton.

I have found a class of native vines the leaves of which are very subject to sun-scald. Their leaves are thin, smooth, without gloss, containing very little juice. On such I have never found any form of fungi. The amount of heat necessary to form mildew, other conditions being considered, produces sun-scald on leaves containing little sap. A certain amount of sap is necessary for the production of fungi. Absolute dryness never fosters it. When *B. v. viticola* attacks a vine-leaf, it produces, either by the absorption of the sap or by cellular disorganization caused by its presence, a whitish, spotted appearance at the points of attack, and causes the leaves to wither.

The results of the investigations of Dr. Hales, concerning the circulation of sap through the main trunk of the grape-vine, show the importance of understanding the relative force of sap circulation in different species and varieties of vines, and the consequent effect on the assimilation of plant-food.

Dr. Hales having made a cross-cutting in a vine-trunk, and secured to the vine a tube so arranged that it would virtually constitute a continuation of the cellular arrangement and air-tubes, combined with this contrivance a bent glass tube, containing mercury, and forming a sort of barometer, in which the movements of the mercury depended on the

pressure of the trunk-sap. In one experiment he found the force of the sap equal to the weight of thirty-eight inches of mercury, showing a force nearly five times greater than that of the blood in the crural artery of a horse, and seven times greater than the force of the blood in the artery of a dog. Burcke found that in a vine the spring sap, having a specific gravity of 1.0008, raised a column of mercury to the height of fourteen and one half inches, and therefore exerted a pressure equal to that of a column of water one hundred and ninety-five inches high. In another experiment, sap of specific gravity 1.0009, raised the mercury to the height of seventeen and one half inches.* It was also found that the pressure of the sap was affected by the atmospheric pressure; even the changes of sun heat and light modified it. The sap of plants is much influenced in its conditions by atmospheric variations, and contracts or expands according as the pressure of the external air is increased or diminished. During a low atmospheric pressure, should the leaf-sap pass through the pores of the leaf to the surface, moistening it with albuminous juices, the food of fungi, then a high temperature following, all the conditions necessary for the formation of fungi are present. It has long been observed that rust, mold, mildew, and smut follow such a course of atmospheric variation. Theoretically, a shower of rain, though the result of low atmospheric pressure, will not prove injurious to the leaves of plants, its tendency being to remove from them all soluble and insoluble substances. Sprinkling the leaves has the same effect, while dull, hazy weather has the opposite tendency.

The California climate, with the exception of the sea-coast, and especially where the prevailing western winds drive the fogs over the locality, is eminently adapted to the culture of grape-vines, and it is proved conclusively that no European locality can equal, within 200 per cent., its productiveness. The oldest inhabitant has no recollection of a failure in crops of grapes.†

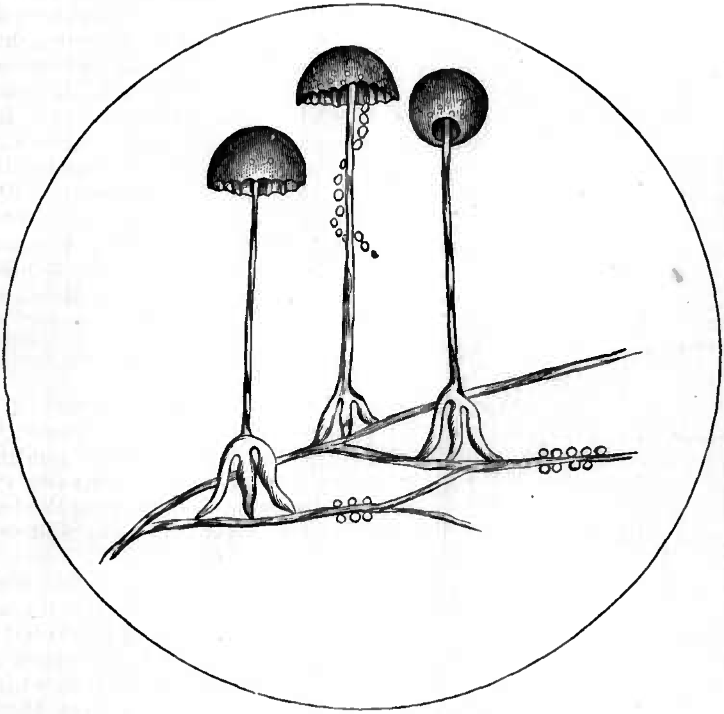
During the potato disease in Ireland it was generally observed that *Botrytis infestans* (potato fungus) frequently appeared after dense fogs. A heavy shower of rain seemed to revive the foliage, while continued heavy showers, followed by high temperature, seemed to have an effect on the foliage similar to heavy dews and fogs, by surcharging the leaves and stems with moisture, particularly during a period of fungoid prevalence.

I have lately observed on native grape-vine leaves a singular serpentine white line. A microscopical examination of it shows that the white substance consists of *mycelium* intermixed with groups of perfected conceptacles or fruit of an *Erysiphe* fungus, (a form of fungus found only on living vegetable matter.) On the removal of this mildew, which to all appearance was wholly on the surface, it was found that the mildewed path was confined to the track of a "leaf miner." It is evident that the "miner" in its passage between the upper and lower surfaces of the leaf destroyed the cell-walls on both sides of its track, causing the juices to escape and permeate the thin and porous epidermis, thus creating an opportunity for the fungous growth. It appears probable that when the leaf-juice pervades the surface of the leaf, it retains for a time its living organic functions, maintaining a continued connection with the cellular matter within the leaf. When a vine-leaf is bruised to a pulp and exposed to the air, fungi of the genus *Mucor* (microscropical toadstools, see Plate 3) make their appearance in various forms. It is an established fact that the vital constitution and composition of any body regulate the forms of the fungi which grow upon it, subject,

* Encyclopædia Britannica, vol. v, p. 112.
† Transactions of the California State Agricultural Society.

PLATE VI.

[PLATE 3 OF FUNGOID SERIES.]



MICROSCOPIC TOAD-STOOLS.

This form of fungus is found on the vine leaf when reduced to a pulp and fermented.

however, to climatic modifications. I found an *Erysphe* fungus maturing to perfection on a bunch of grapes taken from a foreign vine several days after it was removed from the vine. Although the ripening of fruit after removal from the vine is not necessarily the result of organic life, it is probable that for a time after removal from the parent wood, fruits, leaves, and branches retain the life principle, (and consequently continue to have the power to support fungi peculiar to living vegetable matter.) Saussure's experiments on the bough of a cactus seem to confirm this view. Having detached a bough of a *Cactus opuntia* from the plant and placed it in common air, he found that in the course of one night the branch inhaled four cubic inches of oxygen. But when he cut it to pieces and pounded it in a mortar, no inhalation took place; and there may again be noted the distinction between the growths of fungi on living and dead matter, for it is not until the exudations of the plant have wholly lost vitality that the fungi peculiar to dead matter will appear on them, these growths in their turn affording support to other fungi.

On the first introduction of heated air into the hospitals of Europe, it was found that the cuticle of the patients cracked and peeled, but this evil ceased on the introduction of water into the wards. It has also been found that very dry and heated air, in vine hot-houses, favors the growth of *Erysiphe* fungi, and microscopical observations may yet show that a very hot, dry atmosphere causes a partial destruction of the epidermis of vine-leaves, and by this means an exudation of juice on the surface of the leaves. This view seems to be confirmed by the fact that moistening the floors of hot-house graperies retards the growth of *Erysiphe.* But in vegetable, as in animal life, a particular disease may, at different times, originate from different causes.

As albumen forms one of the important proximate principles of grape-juice, it may be well to consider what action is exerted upon it by potash and phosphoric acid and other substances, when applied to the soil as plant-food. Some substances, on coming in contact with albumen, coagulate it at once, thereby retarding circulation. It is coagulated by several organic bodies; for example, tannic acid and creosote, which latter acts catalytically, a little sufficing to coagulate a large quantity of albumen without entering into combination with it. Most mineral acids, as sulphuric, chlorhydric, nitric, and pyrophosphoric, precipitate it in the insoluble state. Solution of bichromate of potash, of alum, corrosive sublimate, subacetate of lead, and many other substances, precipitate pure albumen from its aqueous solution, just as they do the whites of eggs. When several volumes of ether are added to a concentrated solution of albumen, a gelatinous substance is formed. This mass re-dissolves in water if this be added immediately; but if the water be added after a short delay, it will not then effect dissolution. This property of sulphuric ether points to an easy method of destroying fungi, and even insects, such as the "mealy bug." Sulphuric ether, alcohol, and many other substances, destroy insect life when applied to the foliage in strength sufficient for the purpose, and in so doing coagulate the albumen of the juice, stop the circulation and destroy the foliage. But it would seem from the observations of Wurty that when water is applied at once the albumen is again rendered soluble. In this way the insects and fungi might be removed without destroying the plant. Dilute alcohol would probably serve the purpose better than sulphuric ether, since the former is soluble in all proportions of water while the latter is not. Indeed, sulphuric ether, when pure, may be washed in water without combining. The experiment should be tried first on a small plant.

Weak acids do not precipitate albumen. It is soluble in aqueous solutions of potash, and in considerable quantities of chlorides, also in cold phosphoric and acetic acids. The latter, when concentrated after a few hours' exposure to the air, coagulates the albumen. Caustic potash, lime, soda, and ammonia also render it soluble. It is also worthy of remark that although the acid solutions of metallic oxides prove destructive to plants, the alkaline solutions of the same metals do not coagulate albumen, and therefore are not equally injurious. When the oxides of acid solutions are precipitated by the action of alkalies, and re-dissolved by the latter, vegetable life is not destroyed by their presence. Hence the value of soluble alkalies in the soil. Phosphoric acids and potash are solvents of albumen, and render the sap of plants more fluid, assisting circulation, besides being valuable as plant-food, and their presence in quantity probably retards the growth of the fungi. It has long been observed that grape-vines grown under the eaves of houses, against brick and stone walls, and protected by trees, are less liable to fungoid growth than those grown without protection. Uniformity of temperature is the chief benefit derived from this protection, and the heat is not only more uniform but greater in quantity. Dews are prevented, as well as the partial stagnation of the sap. Cloudless nights favor the formation of dews, but clouds reflect the earth's heat back to the earth, raising the atmospheric temperature and preventing the condensation of the moisture of the air upon the vines. The eaves of houses and the foliage of trees have a similar effect.

The presence of soluble mineral salts in the juices of the vine-stock retards their freezing. Thus, a solution of sulphate of soda, saturated above the freezing-point in a flask, may be cooled many degrees below it without freezing. Despretz says that in low temperature, in the case of water containing more than 24.7 parts carbonate of soda, the salt crystallizes before the water. A similar action is observed in sea-water. Plant-juices containing soluble salts in solution will not freeze at 32°.

The foliage of plants may suffer from chilling winds without freezing, and injuries from these causes are the more to be feared because they are not immediately visible.

The "storm-glass," although a mere toy, shows beautifully the chemical changes which take place from chilling winds and atmospheric changes. During warm, agreeable weather, the fluid which it contains is perfectly transparent, but on the approach of stormy weather, with high and chilling, though not freezing, winds, the salts of the preparation crystallize and become opaque. Solutions of paraffine in colorless coal-naphtha become thick in advance of stormy weather. The paraffine separates in needle-like crystals and becomes cloudy. The sap of all plants containing soluble salts is affected in a similar manner.

Mr. A. Haraszthy recommends that the vineyard planter consider whether he is planting for wine or for the grape market. If for the former, he must look for a soil which is made by volcanic eruptions; and the more magnesia, lime, or chalk the soil contains, the better. This kind of soil never cracks, and it retains moisture admirably during the summer. Such soils, he says, will produce a wine that will keep good for fifty or one hundred years and improve annually, not being liable to sour, or, on exposure to the air after one year of age, to become turbid and change color in the bottle or glass. If such a soil cannot be had for the vineyard, a shell-mound may be accepted as next best in character, and capable of giving a good wine in great abundance. A light, sandy, gravelly soil will give an abundance of wine, but

not of good keeping quality. The wine will soon change color and become sour when exposed to the air, and the only mode of keeping it for years is by the addition of brandy or alcohol.*

In this statement the chemical condition of the soil is not considered. Its mechanical state is doubtless highly important, but its chemical condition is also important. Mechanical conditions may retard or assist chemical development. The microscopical discoveries of Pasteur, and the discoveries of De Bary respecting fungi, in conjunction with the observations of Hoffman, may lead to results of great value to the vineyardist.

Pasteur discovered that the fermentation in wines resulted from the presence of germs of fungi. De Bary's experiments tend to prove that, although the spores of fungi are not absorbed by leaves, their germinal matter is, especially by the cotyledons, or seed-leaves of plants. Hoffman and others have shown that plants will absorb into their system dye-stuffs, coloring the very leaves; thus yellow prussiate of potash and other salts have been absorbed through the entire cellular formation without decomposition. It has been fully demonstrated that foreign substances, when sufficiently soluble, have been absorbed by the roots of plants. The conceptacles of an *Erysiphe* fungus, although too large for absorption by the roots or stomata of the leaves, or of the green parts of the branches, supply, when broken, a fluid which contains the germs of fungous life, and which may be absorbed. When a conceptacle is crushed between glass slides and placed under the microscope, it appears as in Fig. 7, plate 2, a fluid being seen flowing from the opening made.

When pure sugar is held in solution in pure water, fermentation does not take place, although the temperature may be favorable; but when vine-leaves are added to the solution, fermentation commences; and when a portion of the fermenting liquid is placed under the microscope, the budding spores of fungi are seen in active growth. Organic acids are formed during the decomposition of vegetable matter, (as in underdrained soils,) presenting conditions unfavorable to the growth of plants. The presence of decomposing vegetable matter could not be injurious to plants, did the roots simply absorb from it pure water. The fact that the roots of plants rot when kept in stagnant water is sufficient proof that germinal matter of fungi has in some way affected the plant, but the leaves and branches are also affected, giving proof of internal disease. There is found on the Department grounds a matured Devereaux vine, which, though apparently very healthy in foliage and wood, yet, owing to mildew, fails to mature its fruit. A cutting from this vine exhibited in the third year of its growth more fungi on its leaves than did all the native vines put together. In this case there is some evidence of contamination in the juice. If the germinal matter of fungi is absorbed by the roots of plants, or by the seed-leaves, it follows that drainage should be resorted to as a means of prevention. But in many cases the formation of cells of fungus and organic acids may be prevented by the application to the soil of lime and its compounds, the carbonate of lime, if in sufficient quantity, neutralizing all acids, whether mineral or organic. The sulphate of lime, being soluble in 500 parts of water, no damage can be done from its presence in excess. The carbonates of potash and soda being very soluble in water, their excess in the soil would injure the roots of plants.

It is worthy of note that the wines made from vines of volcanic regions

* Haraszthy's report on the grapes and wines of California, p. 314, Transactions of California State Agricultural Society for 1858.

have less tendency to ferment than those of moist valleys, and of sandy and gravelly regions when devoid of limestone.

MILDEW ON THE EUROPEAN GRAPE-VINE.

The European grape-vine grown in hot-houses in the United States is subject to a prevalent form of mildew similar to, if not identical with that which proves destructive to the vines in Europe, known as *Oidium Tuckeri*. Plate 4 represents its various stages of growth. The cause of its growth is still an open question, and is being discussed by the leading mycologists of Europe.

Some forms of mildew are produced by excessive moisture, assisted by a certain degree of heat, while certain other forms are matured only under comparative dryness and heat. *Oidium Tuckeri* seems to be of the latter class, judging from an experiment recently made in one of the hot-houses of the Department, and believed to be the first test experiment of its kind. An experimental glass-house, in which grew a variety of grape-vines, native and foreign, was selected for the test. Mr. Saunders, the superintendent, gave orders, on the 24th of June of the present year, that the usual watering of the house be dispensed with for a time, at the same time stating that, as a consequence of this withholding of water, *Oidium Tuckeri* would quickly appear. In twelve days afterward this fungus made its appearance on the foreign grapes, covering them in a few days with a heavy coating of mildew of a very destructive character. The leaves and stems were also covered with the mycelium spores and fruit of the fungus in all its stages.

It is not supposed that extreme atmospheric dryness alone produces this mildew. The organic germs may be connected with the vine internally or externally, but heat and a certain degree of dryness would seem to foster its growth in a material degree, and the experiment proves that extreme dryness facilitates the growth of this fungus. Although the hot-house in which the foreign mildewed vine grew contained several native vines, the branches of which intertwined with those of the foreign, the *Oidium* did not affect either the fruit or leaves of the native vines. The vines are five years old.

In the new grapery, where about one hundred two-year old foreign vines are growing vigorously, a single leaf of the Early Smyrna was observed, on the 24th of June, to be slightly mildewed on the upper surface. This occurred just opposite a bottom ventilator which had been probably left open for a few days, and the action of dry air being continued, a few more leaves became mildewed. These examples illustrate fully the tendency of dry air to mildew the foreign grape-vine under a certain degree of temperature. The *Oidium* is generally first seen on a single leaf. It resembles water stains, but is easily detected.

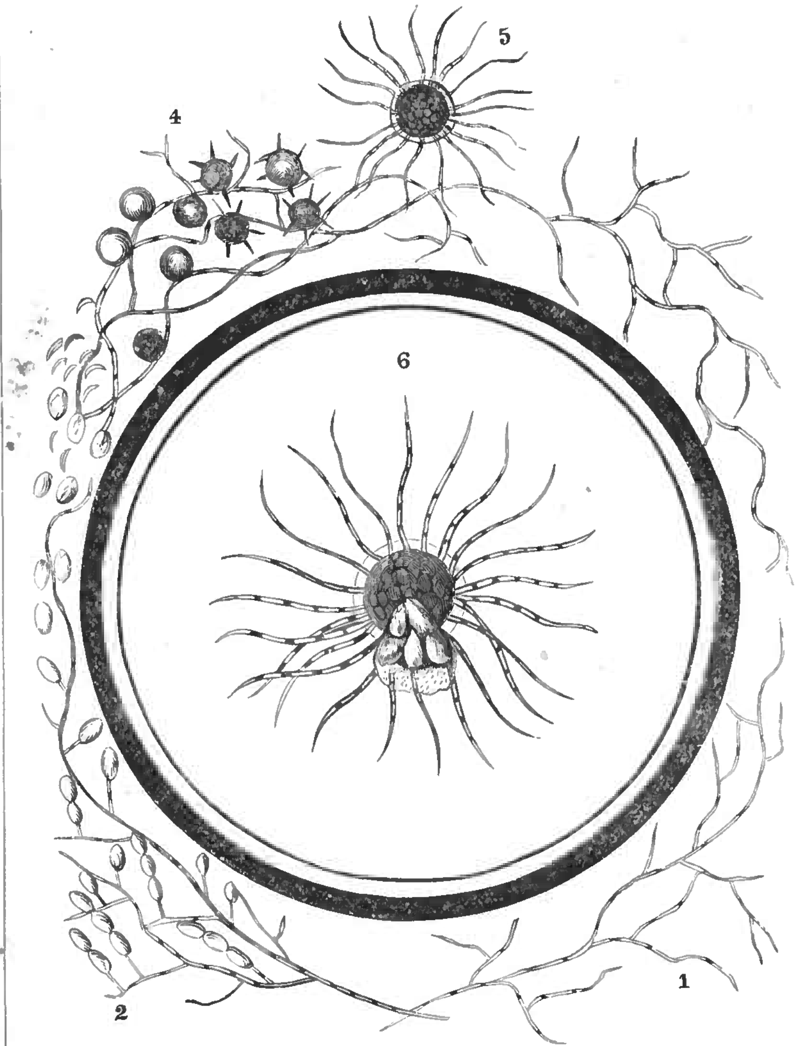
The moist cool climate of England is not favorable to the growth of this particular fungus, but all writers concur in the statement that *Oidium Tuckeri* was first observed in a hot-house in England in 1845. In 1847 it first appeared in France, in the hot-houses; then it spread rapidly to the trellised vines, and to those cultivated near the ground. It then invaded Spain, and in 1851 it appeared in Italy. A certain amount of moisture, organic life, and a given temperature are necessary to its development.

It is a singular fact that the perfected fruit of this fungus has not been hitherto seen. Cook says:

The vine disease, so fearfully destructive on the continent, and not altogether unknown in this country, [England,] is another of these incomplete fungi. From an in-

PLATE VII.

[PLATE 4 OF FUNGOID SERIES.]

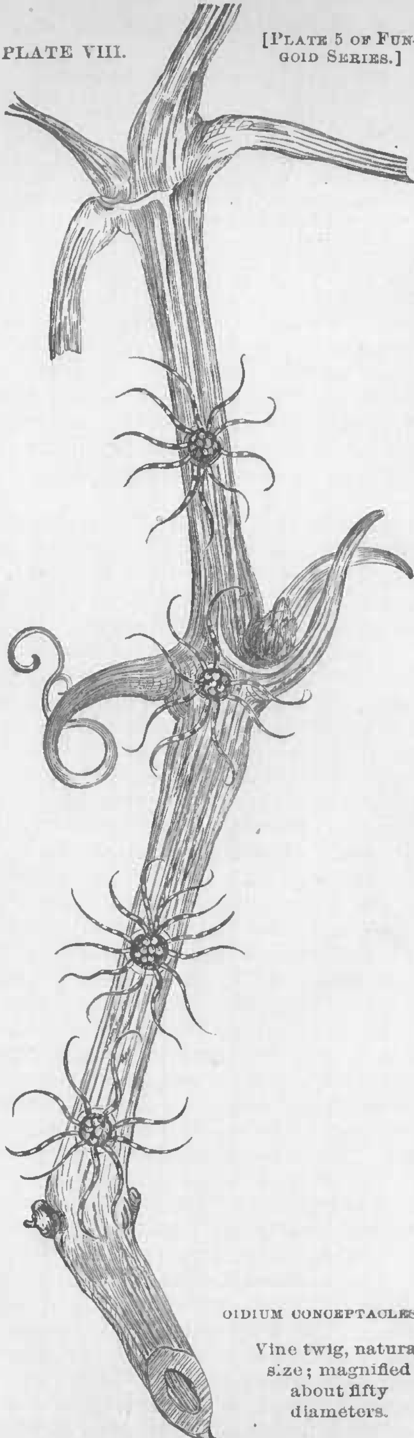


OIDIUM TUCKERI.

An erysiphe fungus of the European grape vine. Figs. 1, 2, 3, 4, 5, and 6 represent its various stages of growth. The small conceptacles (4) are first yellow, then change to brown. Fig. 6 is represented in the act of bursting and throwing out its sporangia.

PLATE VIII.

[PLATE 5 OF FUNGOID SERIES.]



OIDIUM CONCEPTACLES.

Vine twig, natural size; magnified about fifty diameters.

dividual who, at the time of its first discovery in the south of England, took considerable interest in the subject, it was called *Oidium Tuckeri*, which name it continues to bear, both here and abroad, until, with many others, probably nearly all of the same genus, it was found to be only a *barren state* of what is called by mycologists an *Erysiphe*. The real discoverer of this mildew was undoubtedly the Rev. M. J. Berkeley, who has successfully devoted a long life to the study of these minute organisms. In Berkeley's Cryptogamic Botany, page 274, he says that in the vine *mildew* no *ascigerous sporangia* (perfected fruit) has yet been found.

The position assumed is, that this mildew, so far as has been observed in England and on the continent of Europe, consists only of mycelium and spore formations, as exhibited by Figs. 1, 2, 3, 4, and 5, Plate 4, Fig. 6 being its perfected fruit. Where this species of fungus attacks the young grapes it destroys the outer skin, (epidermis,) which ceases to grow, while the interior portion continues to swell, and, as a consequence, the berries burst, showing the seeds. The climate of this district seems highly favorable to the perfected growth of this fungus. We have collected many specimens containing all the forms of its progression, some of which have been photographed. Fig. 6, Plate 4, is a specimen.

When this fungus attacks the leaves of the foreign vine, slightly transparent spots are observed, showing a seeming internal chemical change. The next stage appears of a whitish color; few would suppose it to be mildew, but, when transferred to glass slides, its whole formation is distinctly seen under the microscope. In its first stage, on the surface of the leaf, (see Fig. 1, Plate 4,) it may be easily destroyed, or at least greatly retarded in its growth, being simply in the mycelium stage, (a thread-like form,) by the application of sulphur or its compounds, either in dry powder or as a wash. When sulphur is fluxed, or boiled in water with potash, soda, or lime, the sulphur combines chemically with the alkali, forming sulphides soluble in water. The sulphides of calcium, potassium, sodium, and ammonium are very soluble, and should be highly diluted when used as washes; no more should be dissolved in water than is required for immediate use. When exposed to the air they change in chemical composition, the sulphide of calcium becoming sulphate of lime, and the sulphides of potassium and sodium becoming, respectively, sulphates of potash and soda. So long as the solutions are of an amber color, however pale, they are fit for use, and contain sulphur in solution as a sulphide. The sulphates of the alkalies are colorless.

The usual mode of transferring the delicate forms of mildew to glass slides consists in removing a portion with a point, placing it on a glass slide, and securing it with a varnish ring under a thin disk of glass. This mode destroys the natural arrangement of the mycelium, spores, &c., to prevent which I devised the following mode of transferring the mildew to glass, as a means of perfectly exhibiting their various forms under the microscope: Dilute copal varnish to a very limpid condition with benzine, then pour a portion on a slip of glass three inches by one; the superfluous varnish being quickly poured off enough will remain to form a thin film. When nearly dry press gently the leaf, branch, or berry, on the sticky varnish, when a portion of fungus remains. It is next mounted in the usual manner for practical purposes, and is in condition for photographing. Plate 5 represents highly magnified conceptacles, fruit of the foreign vine *Erysiphe* mildew, as seen on their green branches and leaves, which, when not removed, survive the winter. When they burst their spores and protoplasm germinate, covering the green branches, buds, and leaves, in the spring of the year, and penetrating the soft, green branches from which they draw their support.

The application of a wash to the vine-branches in the fall of the

year, by means of a long, bristled brush, would probably remove or modify the evil influence of fungi, as well as the germs of insect life which may be on the trunks and branches. Should the protoplasm from crushed conceptacles or spores, consequent on the friction from brushing, flow over the parts affected, the wash employed should have the property of coagulating the poisonous fluid. Weak solutions of tannic acid, carbonate of lime, and alcohol, will produce such results; probably the tannic acid would prove the least injurious to the vine.

DISEASES OF THE PEAR.

A Beurré Langelier pear-tree growing on the grounds of the Department has failed during the last two years to perfect its fruit. When the fruit is nearly matured it becomes pitted, and softens under the skin, an internal decomposition or rot sets in, and the fruit decays. Plate 6 represents its appearance under this disease.

On placing a portion of the decayed pear under the object-glass, my attention was first directed to numerous spores of fungi and branched mycelium in the brown, decayed portion. In my second day's observations I found very small, snake-like forms of the genus *Anguillula.* These entozoa are especially remarkable and interesting on account of their tenacity of life, resembling in this respect the *Tardigrada* and *Rotatori.* Thus *Anguillula fluviatilis*, when exposed to the heat of the sun, becomes soft, but takes food and exercises its reproductive functions as before.

The same tenacity is possessed to an extraordinary degree by *Anguillula tritici*, which will revive after having been kept in a dry state for more than five years; it is not even destroyed by being frozen. *Tritici* is found in blighted wheat, sometimes infesting the young plants, burrowing in the leaf-sheaths in great numbers.*

After many experiments on the juice of the pear as to the best mode of detecting entozoa, and of separating them from the cellular matter, I was able to secure them alive in great numbers. I herewith submit drawings representing their various stages of growth. Figs. 1, 2, and 3, Plate 7, represent those found alive. Figs. 4, 5, 6, and 7 are those which did not exhibit life, and were probably in the embryo state. Groups 9 and 10 represent spore formations found within the pear in the decaying pulp. All are highly magnified.

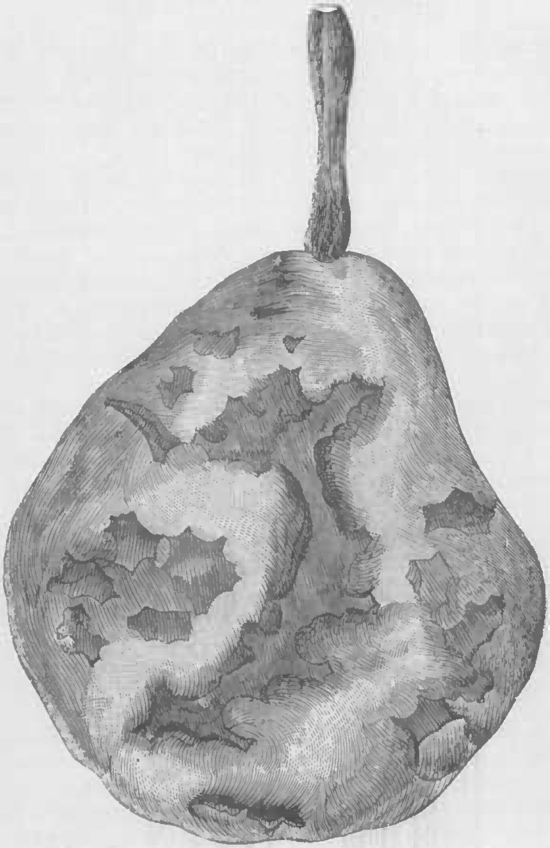
The presence of entozoa and fungi in the pears of this tree explains the cause of their rapid destruction. Broken or decomposing cells are distinctly seen under the microscope. Under decomposition the pear becomes soft and watery, and at this stage of decay entozoa come to maturity, and move about from place to place through it. By placing a portion of the cellular matter in a piece of muslin and applying pressure, a thick juice passes through the mesh, and a single drop of this, thinned with pure water and put under the microscope, exhibits these animals moving about like snakes through the liquid, greedily eating spores of fungi and cellular matters. I have no theory to advance for the presence of these animal forms in the center of fruit fresh from the tree. Further researches may develop the true source of their existence, but their detection for the first time thus situated may lead to some practical results in the manufacture of vinegar from apples.

Fruit-growers in some of the States complain of their inability to manufacture apple-vinegar profitably, owing to the vast number of

* Griffith & Henfrey's Microscopical Dictionary.

PLATE IX

(PLATE 6 OF FUNGOID SERIES.)

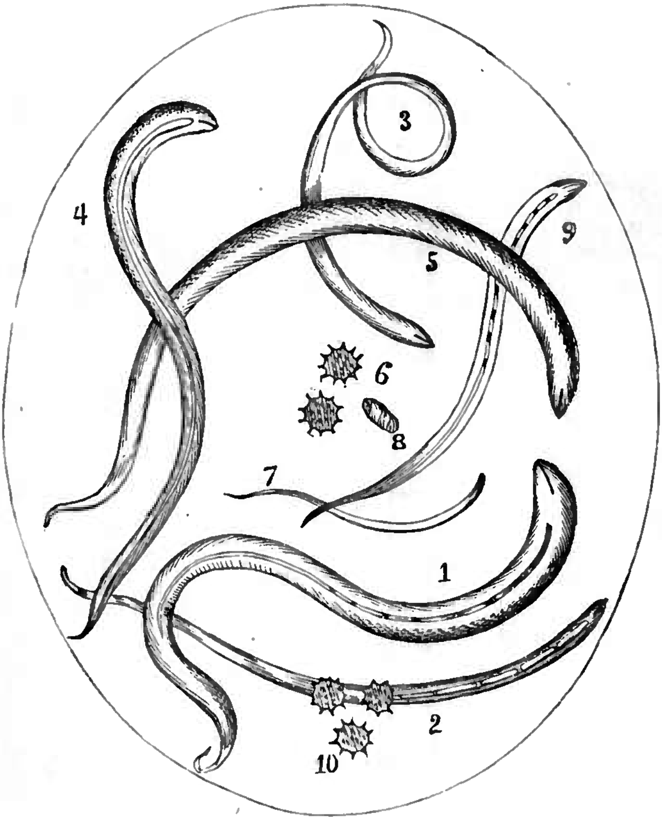


DISEASED BEURRÉ LANGELIER PEAR.

Attacked by fungi and entozoa.

PLATE X.

[PLATE 7 OF FUNGOID SERIES.]

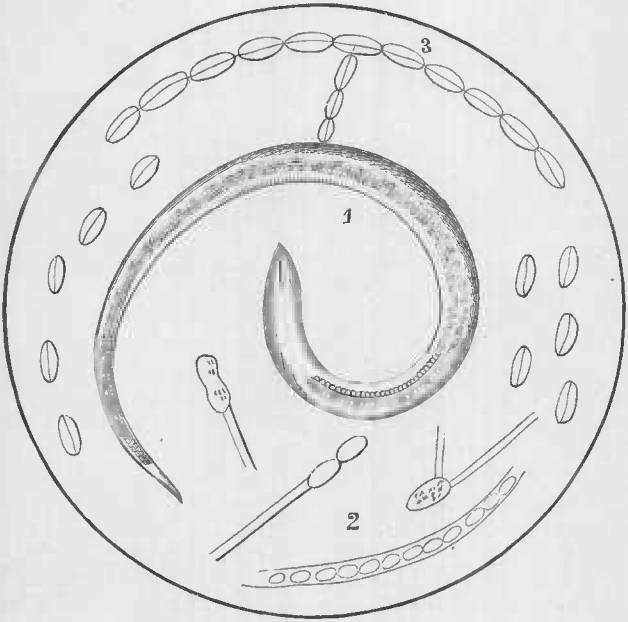


ENTOZOA FOUND IN THE BEURRÉ LANGELIER PEAR, AND KNOWN AS "ANGUILLULA."

This genus was formerly placed among the Infusoria, but is now arranged in the order Nematoidea.

PLATE XI.

[PLATE 8 OF FUNGOID SERIES.]



ENTOZOA AND FUNGI WHICH ATTACK THE TOMATO.

Entozoa in the embryo and active state found in trophy tomato.

vinegar "eels," so-called, germinating in the expressed juice, and for this reason many have abandoned its manufacture. The discovery of these entozoa in fruit while on the tree proves that investigations need no longer be confined to the vinegar or atmosphere, but to the fruit. Further researches may trace their existence still further back. It is the province of science to continue such investigations until the root of the evil is discovered and the germs destroyed.

The British vinegar manufacturers have also suffered from the presence of these animals. They have found that by adding a very small portion of chemically pure sulphuric acid to the vinegar their presence was prevented, and an act of Parliament was passed allowing a small portion of sulphuric acid to be used, and the manufacture of apple-vinegar was thereby rendered profitable. (As commercial sulphuric acid always contains arsenic, only the chemically pure should be used.) Since I found entozoa in the pear, I have examined other fruits to ascertain their condition in this respect, and have found them in great abundance in the inferior varieties of peaches, and in slightly decaying tomatoes and apples. I have also found a few in the perfect peach and apple, showing that the germs were there, needing only favorable conditions to become developed. The entozoa found in the respective fruits examined differ from each other in their internal and external forms, and are all invisible to the naked eye. Fig. 1, Plate 8, represents the perfected form of the entozoon of the Trophy tomato; Figs. 2 and 3, spores and mycelium formations.

FUNGOID DISEASES OF THE PEACH-TREE.

On the 11th of January, 1872, I commenced a series of experiments and observations on peach-tree bark, embracing that of the roots, with the view of ascertaining, if possible, the cause of the disease known as the "yellows of the peach." To that end I selected specimens of the bark of a tree affected with this disease, and also the bark of a healthy peach-tree, removing in each case all the layers, including the liber or inner bark. I examined the specimens as removed with a low power, but failed to discover any form of fungus. Thinking that the fungus in the bark, if any, might be in the form of germs only, I next submitted the specimens to the action of water, placing each in a cup of water by itself, and subjecting them both to a uniform temperature. The liquids were examined daily. On the sixth day of maceration I found a copious supply of mycelium in the albuminous matter of the liber. Plate 9, Fig. 1, represents its first stage; Figs. 2, 3, 4, and 5, other stages of fungi growth found in connection with it. The mycelium, when matured is jointed and branched. The threads are only the fifteen-thousandth of an inch in diameter. At the present stage of investigation it would be premature to attempt to describe its various stages; further observations are necessary. During the spring and fall of the year the leaves and fruit should be examined. It is possible that the perfect form of the fruit of this fungus will be found on the decaying leaves. In the healthy bark infusions, thus far, no fungi are visible. I combined the infusion made from the bark of the unhealthy tree with acetate of lead in solution, which precipitated the albuminous matter, a portion of which, when placed under the object glass, of 250 diameters, exhibited a black, dotted appearance. Experiment and observation may develop the fact hereafter that the dotted structure is the germinal matter of fungi. From present observation it would seem that the fungus of the yellows forms on the last cellular deposit of the cambium

on the liber. The maceration of the bark of the trunk and branches exhibits the presence of albuminous matter in which a profusion of mycelium is found. The bark of the roots has a very limited portion of albumen. When the albuminous matter is in profusion, monads and fungi readily grow, but the converse condition gives opposite results; hence the absence of fungi in solutions of the bark of the roots. Solutions of the healthy bark gave no signs of fungi. These experiments were frequently repeated, giving uniform results. This disease, so well known to the horticulturist, was first observed about the year 1800, or a few years previous. Attention was attracted in the neighborhood of Philadelphia to the sudden decay and death of the orchards without apparent cause. From Philadelphia and Delaware the disease extended to New Jersey, where, in 1814, it was so prevalent as to destroy a considerable portion of all the orchards. About three or four years later it appeared on the banks of the Hudson, or from 1812 to 1815, gradually and slowly extending northward and westward to the remainder of the State. Its progress to Connecticut was taking place at the same time, a few trees here and there showing the disease until it became well-known (though not generally prevalent) throughout most of the warm parts of New England. Downing states that no writer has yet ventured to assign a theory supported by any facts which would explain the cause of peach yellows. Noyes Darling, of New Haven, Connecticut, says:

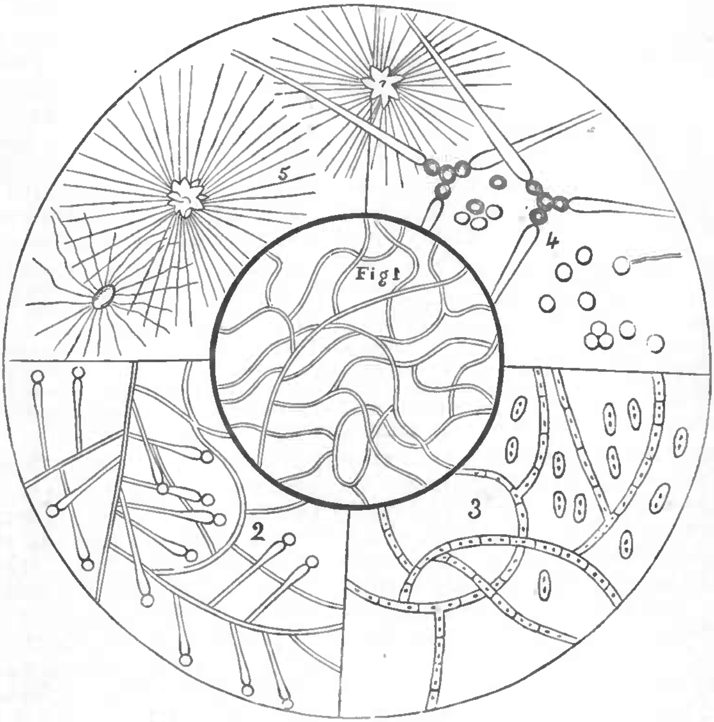
When the disease commences in a garden or orchard containing a considerable number of trees it does not attack all at once. It breaks out in patches, which progressively enlarge, till eventually all the trees become victims to the malady. Thus, in an orchard of two and a half acres, all the trees were healthy in 1827. The next year, two trees on the west side of the orchard, within a circle of four rods diameter, took the yellows. A similar fact is now apparent in my neighborhood. A fine lot of two hundred young trees, last year in perfect health, now show disease in two spots near the opposite ends of the lot, having exactly six diseased trees in each patch contiguous to each other, while all the other trees are free from any marks of disease.

It has been remarked that the most luxuriant and healthy varieties are more liable to it than the slow-growing sorts, which are said to be rarely affected. Many fruit-growers suppose that this disease has its origin in spring frosts; but it should be observed that in the multiplicity of reasons given for the yellows, the disease is unknown in Europe. It should also be taken into consideration that peach-trees which grow under the shelter of glass are not affected by the yellows. The character of the soil, then, does not seem to be the cause of the yellows; for the same kind of soil on which the yellows of the peach flourish will produce a healthy peach-tree, if grown under glass structures. Thorough cultivation of the soil may retard this disease, but should its original cause have full sway, it will continue its ravages.

In exposed places, subject to sudden changes of temperature, experiment may yet prove the advantage of winding porous cloth saturated with sulphide of calcium around the trunk and principal branches of the peach-tree, especially when signs of the yellows are visible. The adoption of any system of protection during unfavorable seasons would have a beneficial effect. Sulphur compounds have been used as a paint, with good results. The fact that the threaded mycelium of fungi has been found in profusion on the liber of the peach-tree is sufficient to explain the cause of fruit and leaf disease, since the fruit and leaves are only an extension of the tree. The formation of this mycelium on the wood or inner bark of the peach-tree, when affected with the yellows, explains to some extent the cause of the presence of sheets of mycelium, known as punk or spunk, found frequently between the rings of annual growth of the oak and other trees. The evidence thus furnished in the

PLATE XII.

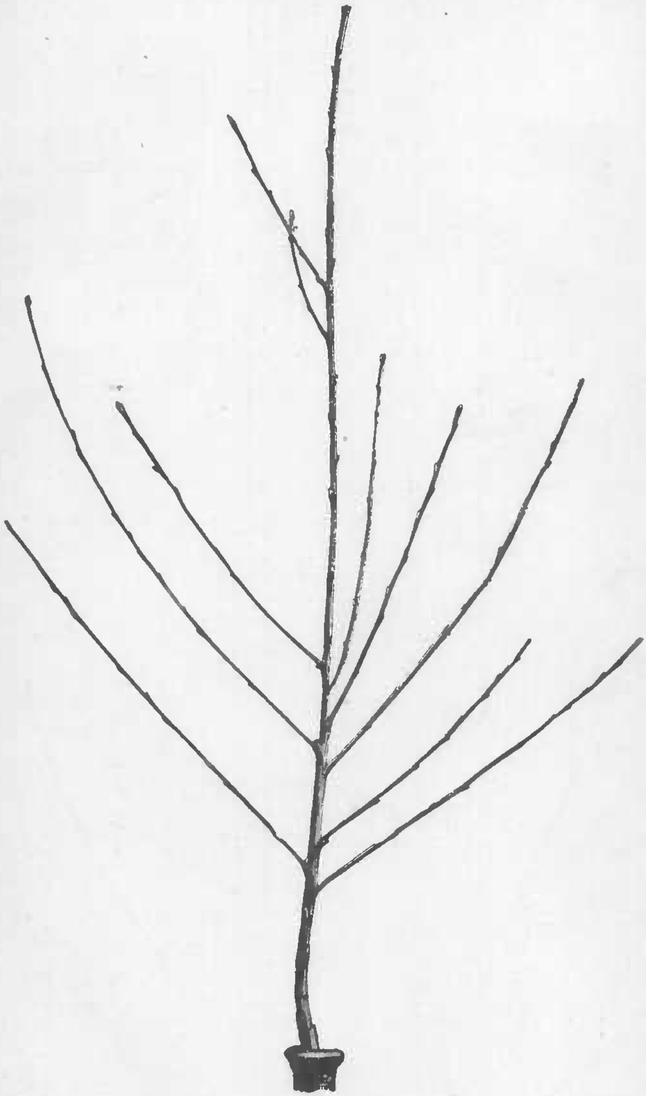
[PLATE 9 OF FUNGOID SERIES.]



MYCELIUM AND OTHER FUNGOID FORMS FOUND ON THE LIBER OF A PEACH TREE HAVING THE "YELLOWS."

PLATE XIII.

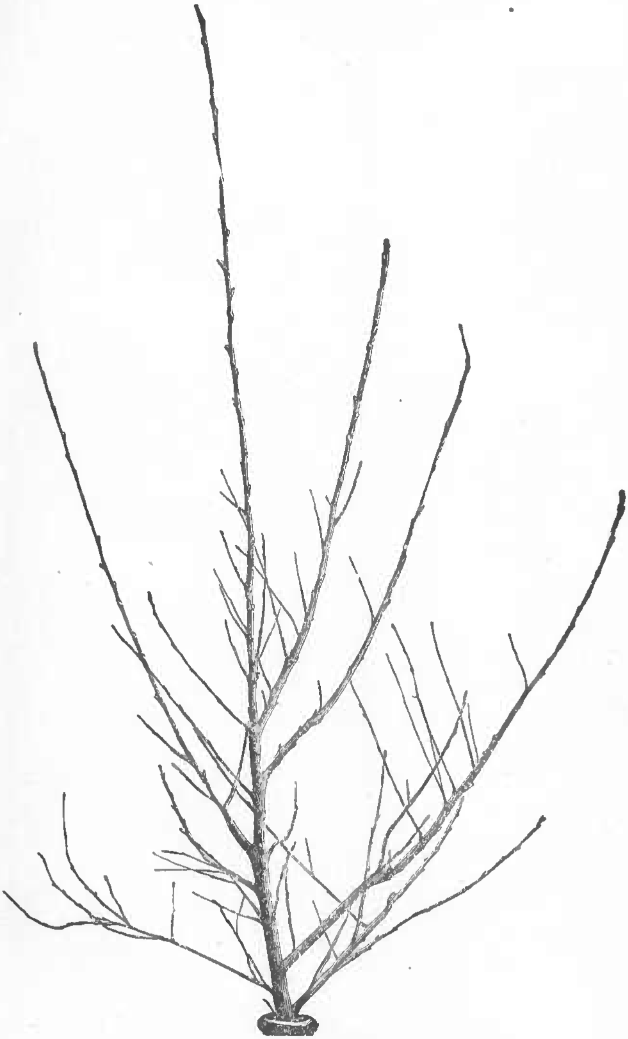
[PLATE 10 OF FUNGOID SERIES.]



TWIGS OF A HEALTHY PEACH TREE.

PLATE XIV.

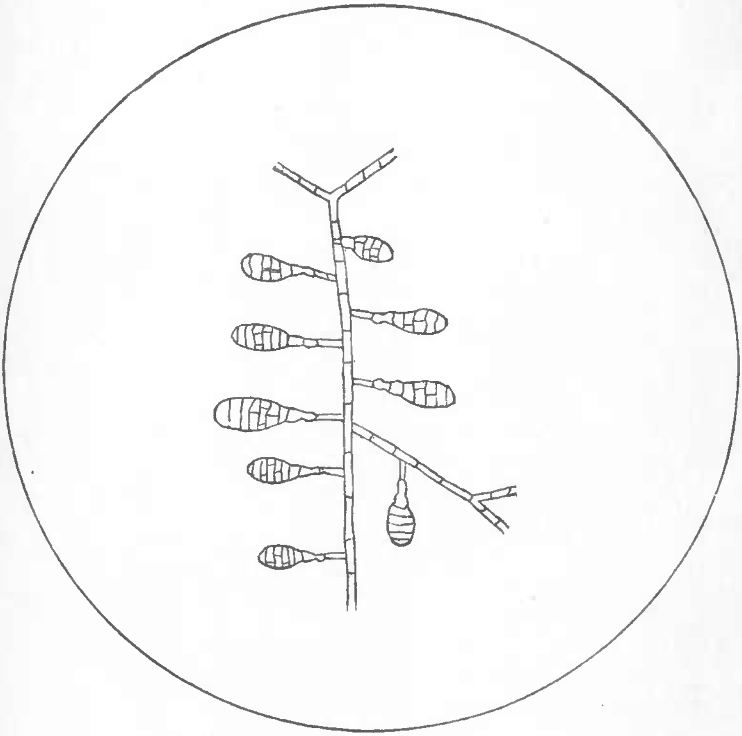
[Plate 11 of Fungoid Series.]



TWIGS OF A PEACH TREE HAVING THE "YELLOWS."

PLATE XV.

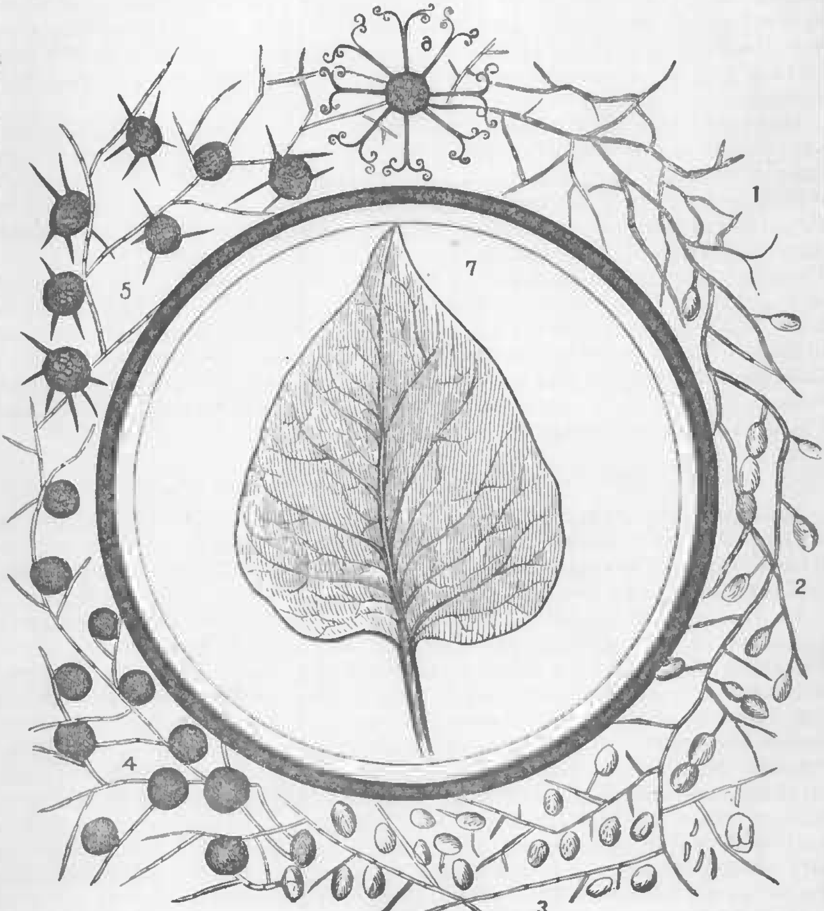
[PLATE 12 OF FUNGOID SERIES.]



FUNGOID SPORES FOUND WITHIN A BLIGHTED LILAC LEAF.

PLATE XVI.

[PLATE 13 OF FUNGOID SERIES.]



MILDEW OF THE LILAC, GENUS MICROSPHÆRIA.

Exhibiting its various stages of growth. Conceptacles (Fig. 5) are first yellow, then change to a brown color.

investigations of the peach yellows favors the view that, when the mycelium is formed on the wood, the cambium cell layers are deposited between the mycelium and the liber, inclosing in this way, annually, a sheet of mycelium, which continues to grow, and necessarily becomes highly compressed or felted. From these sheets of mycelium proceed threads which pass through the pores to the surface of the bark, the ends of which thicken, become bulbous, and ultimately form into "toadstools" or other variety of perfected fruit; these, in turn, reproduce spores, which germinate and continue the work of destruction. The soil itself may become the harbinger of these germinating forms, and in this way the roots may suffer from the absorption of the germinal matter.

Generally the bark of fruit-trees in winter is practically destitute of sap, consequently the solid matter will not suffer from freezing, but in the case of an early spring a partial and premature flow of sap is induced, which is frequently succeeded by chilling winds, and even frost. The structure of fungi, being much simpler, comes to perfection in a much shorter period of time than will a portion of a higher organized plant. Fungoid growth has therefore a great advantage over the higher types of vegetation. The frequent flow and stoppage of the sap has therefore a favorable influence on the growth of fungi, while it has an unfavorable influence on the more advanced vegetable forms. It is not simply frost that the fruit-grower has to fear so much, but the irregularities of the season. Plate 10 represents the twigs of a healthy peach-tree, and Plate 11 those of a peach-tree having the yellows.

THE MILDEW DISEASES OF THE LILAC.

It is generally supposed that every species of the lilac is subject to a form of mildew destructive to its ornamental appearance as a decorative shrub; but investigation has proved that, in this vicinity at least, certain varieties of the lilac do not mildew.

In the arboretum of the Department are growing nearly thirty varieties in one group. On the 22d of August I examined them minutely, and found no mildew; but on the 1st of September slight indications of an *Erysiphe* fungus were visible to the naked eye on all the varieties having dark green leaves, and mildew continued to increase and spread over the foliage as long as the vigor of growth continued. Such of the dark green leaves as did not mildew blackened, blighted, and died long before the fall of the leaf, indicating the presence of some internal disease. When such leaves are ground into a pulp with water, and placed under the object-glass of a microscope of fifty diameters, *mycelium* and spores are at once visible. (See plate 12.) So far as my observations extend, those varieties whose leaves are of a very light green are not infested by leaf mildew during any part of the season. Such leaves, when ground into a powder or pulp, with water, and examined under a power of 1,200 diameters, exhibit neither the spores nor *mycelium* of fungi.

Plate 12, Fig. 1, represents a mildewed lilac leaf, genus *Microsphaeria.* In this case the mildew is not confined to the upper surface; both sides are affected. Fig. 2 represents a highly-magnified view of the first stages, or *mycelium* threads, of the mildew. The remedial applications should be applied to the foliage at this stage of the mildew, before its spores form. Figs. 3, 4, 5, 6, and 7 represent its other spore formations, or stages of growth, to the perfected fruit.

Plate 14 represents a view of its fruit, or last stage of its growth, highly magnified. All the varieties of lilac on the grounds are

growing within a space of fifty feet square, and are subject to the same culture; the differences in composition of saps, color of leaf, and susceptibility to mildew are probably due to a difference of cellular structure.

Professor Graham, in his researches upon the diffusion of liquids, discovered a new means of separating substances which have with difficulty yielded to the ordinary processes of chemical analysis. By allowing complex organic and inorganic liquids to diffuse through a parchment paper diaphragm, he found that they separated into two classes, which he termed crystalloids and calloids, the process of separation being called dialysis. By this dialytic method of analysis arsenic has been removed from a complicated organic solution; soluble silicic acid for stone preservation has been separated from accompanying salts, and many other equally important but hitherto difficult separations have been easily effected. It is probable that this principle of diffusion discovered by Graham is that which acts in the diffusion of liquids through the cells of plants, the cell-walls corresponding to the parchment diaphragms.

Although the deep color of the leaf may depend on causes long anterior to its growth, it is probable that the color, when permanently established, affects the internal chemical relations of the leaf. In the manufacture of carmine it has long been observed that brilliant colors can only be produced under the influence of bright sunshine.*

The mechanical combination of chlorine and water when excluded from light will not change in its chemical conditions, but if exposed to sunlight the water is decomposed, owing to the affinity which chlorine has for hydrogen, and muriatic acid is formed. Light green leaves will allow the transmission of light through them, while dark leaves will exclude and reflect the light, at the same time absorbing more heat than the others. In some cases chemical changes are affected more by the presence of light than of heat, and in other cases heat will cause combinations which are not produced by the presence of light. A combination of bichromate of potash and gelatine may be boiled without chemical change, but when this compound is subjected to the action of light it is rendered insoluble in water; and a knowledge of this fact has been found very useful in recent art enterprises. Albumen, on the contrary, although very similar in composition to gelatine, is coagulated by heat, but not by light. As a consequence of the principles thus illustrated, important changes often result from the mere color of the leaf.

It is well known that the colors of grasses and cereals are very sensibly affected by the use of particular fertilizers, which, when applied in excess, produce very dark green and rank growths. I am brought to the conclusion that in such cases the seeds and all parts of the plant undergo corresponding changes in composition. The changes effected by high cultivation are liable, by persistence in such culture, to become fixed and constitutional peculiarities. On this principle certain modes of culture retard or increase tendencies to mildew. Continued observation and experiment are necessary to a full understanding of the causes of such fungoid growths, and the remedies which should be applied, and it is believed that the opportunities afforded by the arboretum of the Department will lead to a more complete knowledge of this important field.

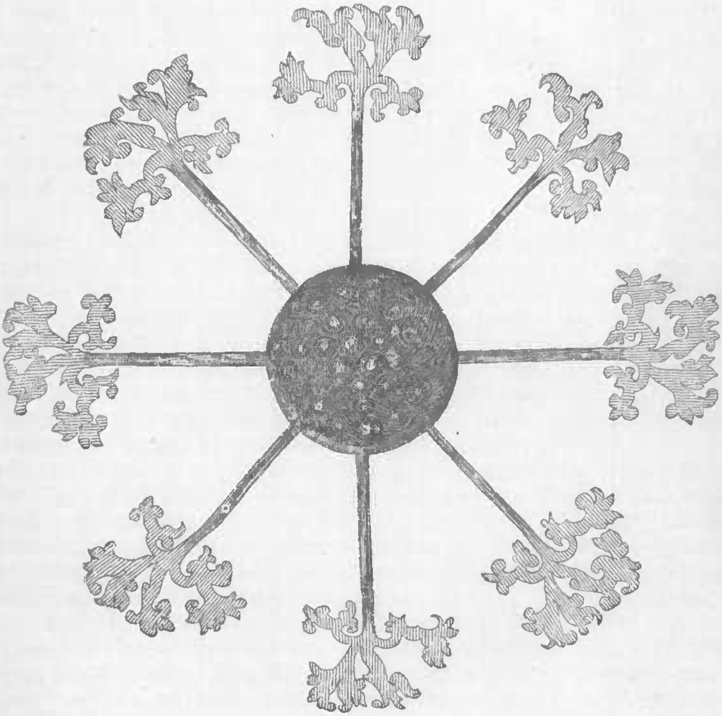
THOMAS TAYLOR,
Microscopist.

Hon. FREDERICK WATTS, *Commissioner.*

* Sir Humphrey's lectures on light. (See "Napier on Dyeing.")

PLATE XVII.

[PLATE 14 OF FUNGOID SERIES.]



GENUS MICROSPHÆRA.

A highly magnified view of the conceptacles or fruit of the fungus which infests the leaves of the lilac.

REPORT OF THE EDITOR.

SIR: The miscellaneous work of the Department has been continued, and that which has been deemed most complete in matter and most suggestive in its teaching has been prepared for publication under my direction, as editor of the annual report.

The topical investigation and the compilation, I may be permitted to say, in justice to others, if not to myself, are mainly the work of persons connected with the Department in different capacities, though subject to editorial direction and revision. Since the era of individual essays the work has been entirely impersonal as to the regular clerical or statistical force of the Department, personal credit sometimes being given to experts or authorities engaged temporarily in aid of some specific investigation. As several thousand persons have annually a part in the furnishing of data used, a public acknowledgment of the source in each case would be a manifest absurdity. Great difficulty has been experienced in obtaining, for these purposes of investigation and compilation, persons combining the requisite practical experience with the tact and judgment and literary ability so essential. Men very useful for other service, with superior education and fine abilities, lacking either practical experience or technical knowledge, either a nice sense of discrimination or the power of generalization, may be utterly worthless for this duty. The exclusive service of men of large agricultural experience and observation—agricultural editors of the highest type—is not often attainable at the rate of $1,200 to $1,800 per annum, and congressional appropriations do not usually recognize exceptional experience or technical skill, but tend to a dead level of mediocrity. This is one of the defects of the civil service, difficult to remedy, but none the less obstructive of progress in a work of this character. While the agricultural public and the rural press have been tolerant, and even commendatory, the editor has found it impracticable to realize fully his ideal of improvement. Were the obstacles to the highest attainment fully disclosed, a sufficient excuse for deficiencies would be furnished, and possibly a suggestion of a higher award of appreciation for the persistent attempt to elevate the character and advance the practical utility of the publication.

It may not be generally known how meager is the pecuniary provision for the publication of these reports, monthly, annual, and special. The fifteen hundred county statistical correspondents, aided by three times as many assistants selected from the ranks of progressive and intelligent farmers after counsel with officers of local societies, congressmen, and others, work without compensation, and give far more trustworthy information than could be expected from salaried agents. The gratuitous labor thus rendered is actually worth, at a miserably inadequate valuation, $100 per county, or a total of $150,000 per annum. Much other gratuitous service is received from farmers, experimenters in the rural arts, consuls of the United States in foreign countries, and others. Not a tithe of the labor of gathering and preparing matter used in the reports is paid for, and the entire appropriation for this object, used in clerk-hire in the Statistical Division, for special statistical investigations, for writing and compilation of material for annual and other reports, has for several years been only $15,000 per annum. Not even the editing of the annual has received the compensation of a single penny for six years, though in that time the publication of 1,430,000 copies has been ordered by Congress. It has been a labor of love, in nearly all of its departments, its contingencies met by an annual dole of appropria-

tions inadequate to supply the matter of a first-class agricultural monthly for three months. With these disadvantages and obstacles before him, the editor is content to leave his intentions and accomplished results with a discriminating and generous public.

In a recent monthly report appeared the following announcement of an important and urgently demanded statistical survey, to be made the basis of a valuable feature in the annual:

Perhaps the most important special work engaging the present attention of the statistical division is the collection of facts illustrating the industrial *status* of Western America, showing the progress of settlement and colonization, the yield and quality of agricultural production, the profit of the several branches of agricultural industry, the peculiarities of climate and soil, and the economic aspects of irrigation, tree-planting, and other specialties incident to rural improvement of the great plains, the Rocky Mountains, and the Pacific coast.

A beginning has been made, but the work has not progressed sufficiently for the publication of any portion of it. It will be continued so far as the small means at hand for statistical investigation may permit, and it is confidently expected that a survey covering one or more of the Territories may be presented in the annual report of 1872. In the present volume is a continuation of the agricultural topography of the Territories from exploration by Rev. Cyrus Thomas, the agriculturist and naturalist of Hayden's geological exploration.

The new industry of the South, fruit-growing for market, which is destined to great expansion in variety and extent of production, is presented in a statistical paper, which is the result of much research. Similar data from Florida, with much of a general character upon the resources and productions of that interesting State, also appear. Among the recent introductions of promising plants for the South, jute is prominently placed, and a brief account of its successful propagation is given.

A classification of the agricultural patents of the year is again made a feature of the report, and the direction of inventions indicated. An investigation concerning weights and measures in the several States will supply a want that has long been felt, and afford much local information upon this complicated subject.

The engineering appliances for irrigation, as employed in Colorado, is furnished by an engineer, Mr. F. J. Stanton, secretary of the Colorado Agricultural Society, and, for purposes of comparison and incidental suggestion, a brief view of the irrigation systems of foreign countries.

Digests of the State reports, reviews of the several publications of the year, briefs of farm experiments, and prominent agricultural facts have their customary place, as indices of current progress and a record for future reference. The peculiar uses and characteristics of American wools are canvassed, with the aid of an expert of unquestionable authority. The annals of industrial education have also been continued, with architectural illustrations.

It has been thought that the agricultural features of the coming centennial of American independence should have a proper presentation, which has been attempted in a paper on that subject.

The question of the relation of agriculture to other industries is an important one, and it has been deemed proper to present certain considerations bearing upon it.

Several investigations are in progress, which must be continued for the publication of 1872.

J. R. DODGE,
Editor of Reports.

Hon. FREDERICK WATTS, *Commissioner.*

TESTS OF DEPARTMENT SEEDS.

Before entering upon the record of experiments of the year it is proposed to present some general facts concerning the comparative advantages of light and heavy seeding with cereals, as recorded incidentally in correspondence detailing tests of seeds. The amount of seed now used to the acre is much less than formerly. No arbitrary rules as to the proper amount can be given, however, as the habits, character, or variety of plant, the nature of the soil, &c., enter into the account. In Cuthbert W. Johnson's Farmer's Encyclopedia, London, 1842, it is recommended that two and a half to three and a half bushels of winter-wheat be sown per acre, broadcast, or two to three bushels, drilled; four to six bushels of oats, broadcast, or three and a half to four and a half, drilled; two and a half to three and a half bushels of rye, broadcast, and two to three, drilled. The amount of seed employed by the best English farmers is now much less than formerly. Mr. George Wilkins, Wix Vicarage, (England,) has given, in the Gardener's Chronicle, the result of his experiments in seeding.

We quote from the report:

For fourteen years in succession he never exceeded two pecks or sixteen quarts of seed wheat to the acre, and sometimes used less than one peck, and yet in each of two of these years he harvested fifty-six bushels of wheat to the acre, and the average of the fourteen crops in fourteen years was forty-four bushels to the acre. The seed was sown with a drill. One of the conditions necessary to the production of large crops from thin seeding he states to be the sowing of the seed early in the fall, that the plants may have a fair start before the setting in of winter. Thorough drainage he also esteems an essential condition.

Mr. T. L. M. Cartwright, another English farmer, experimented with three kinds of wheat, as noted in the annual report of this Department for 1869, page 293. With one peck of seed to the half acre, sown in drills twelve inches apart, he raised thirteen bushels and one peck of Talavera wheat; with two pecks, sown in drills at the same distance apart, he raised fourteen bushels and three pecks; and with four pecks, sown in drills six inches apart, he raised fourteen bushels and one and a half pecks, or three bushels more per acre with a bushel of seed than with a half bushel; and three pecks and a half less per acre with two bushels of seed than with one bushel, though two and a half bushels more than with a half bushel of seed per acre. Experiments with Hunter white wheat and Fenton wheat gave similar results on little larger plats of ground, indicating that the largest proportionate yield was from the lightest seeding named, though that was a trifle too light for the productive capacity of the ground, as shown by the slight increase of yield in each example of one bushel of seed per acre.

Mr. Hewitt Davis, an extensive English farmer, whose experiments in thin seeding are detailed at considerable length in Colman's Agriculture, sixth edition, volume I, found three pecks of winter wheat, drilled, as was his custom with all grain, sufficient for an acre; and the yield from this was frequently forty bushels to the acre. Of oats he used two bushels, and the yield was as high as one hundred and four bushels per acre. In one instance in which two pecks only per acre were sown upon four acres, and five pecks upon four more, the thinner seeding gave the best results. In many years of thin seeding this farmer rarely found his grain diseased in any portion of his field.

In Allen's New American Farm Book, revised edition, 1869, the recommendations for seeding are substantially as follows: Winter wheat, broadcast, one and a quarter to two bushels; drilled, one to one

and a half; spring wheat, broadcast, two to two and a half bushels; drilled, one and a half to two. Oats, broadcast, two to three bushels; drilled, two to two and a half. Rye, broadcast, one and a half bushels; drilled, one to one and a quarter. It is estimated in Todd's Wheat Culturist that one bushel of wheat per acre will give sixteen grains to the square foot, or one kernel to each section three inches square. With winter wheat, which has a greater chance, by its longer period of growth, to throw out from the root numerous stalks, sometimes to the number of forty or fifty under usual cultivation, it will be seen that the wheat stalks, or tillers, from one bushel of good seed upon an acre, must completely occupy the ground. That is all that the farmer can desire his seed to do, whatever the amount sown; hence there can be no object in sowing more than is necessary for the desired purpose. The struggle for existence and food among thickly sown plants must inevitably lead to the partial starving of all, the death of many, and deterioration in the yield, so that, even if the harvest be large, it entails subsequent diminished yield, weakness, and perhaps disease. Spring wheat does not send out so many shoots as the winter varieties, and therefore needs to be sown thicker. This is also true of rye or barley; but the tillering of some varieties of oats is almost as remarkable as that of good, early sown winter wheat. The Excelsior oats, produced by careful cultivation, close selection, &c., from the Somerset stock, and the most vigorous oats imported, as distributed by the Department, are an example. Mr. Colman, in his Agriculture, speaks of having seen ninety-five seed-bearing stems from a single grain of wheat, and one grain, the roots of which being divided and transplanted twice, yielded three pounds, twelve and three-quarters ounces of clear grain, the number of ears being three thousand two hundred and seventy-two. A correspondent informs this Department that one grain of oats produced forty stalks, and that five to twenty from a single seed, under ordinary cultivation and thin seeding, are not uncommon. The following are some of the results of experiments in thin seeding, induced by the small quantities of seed furnished for trial, with both wheat and oats. Mr. William N. Byers, editor of the Rocky Mountain News, Denver, Colorado, collected and sent to the Department, in 1870, results of a number of experiments, from which a few statements are selected:

No. 6. Siberian spring wheat; ("this is our best spring wheat;") ground plowed in the fall; sown April 10; twelve bushels on seventeen acres; not irrigated; harvested August 9; total yield, nine hundred and thirty bushels, or almost fifty-five bushels per acre.

No. 8. Tappahannock fall wheat; sowed November 20; four bushels on four acres; irrigated twice; total yield, one hundred and fifty bushels, or thirty-seven and one-half bushels per acre.

No. 9. Arnautka spring wheat; twenty-five bushels on twenty-five acres; required no irrigation; harvested one thousand one hundred and fifty bushels, or forty-six bushels per acre.

In these experiments even the thin sowing of spring wheat seems to have resulted in no disadvantage. Mr. W. H. Stanton, Bel Air, Georgia, in 1868, with seed at the rate of twenty-five quarts per acre, raised Mediterranean wheat at the rate of fifty bushels per acre. Mr. W. P. Shepherd, Nelson County, Virginia, reports that in 1868 a farmer in that county sowed broadcast thirty-four bushels of Tappahannock wheat on twenty-eight acres, less than one and a quarter bushel per acre, and the yield was six hundred and eighty bushels, over twenty-four bushels per acre, without fertilizers. He adds: "Those farmers who have met with poor success in its cultivation have sown it entirely too thick."

Mr. Charles Baldwin, Pontiac, Michigan, sowed Tappahannock wheat by drill at the rate of not quite one bushel per acre, and the yield was thirty-eight and two-thirds bushels per acre. Mr. Alfred W. Hunt, Perry County, Tennessee, reported to the Department, August 7, 1869, the results of three experiments with Tappahannock wheat, as follows:

No. 1. Drilled September 22, 1868, on rich clay, well drained, at the rate of one peck to the acre; produced at the rate of fifty-two bushels per acre, the grain being superior to any variety of wheat heretofore grown in this county. It weighed sixty-four pounds per measured bushel.

No. 2. Sown broadcast the same date, on similar soil, at the rate of one bushel per acre, produced at the rate of thirty-eight bushels per acre, weighing sixty and one-half pounds per bushel; superior to ordinary varieties.

No. 3. Sown broadcast, the same date, on similar soil, at the rate of two bushels per acre; produced at the rate of fifteen bushels per acre, weighing fifty-eight and one-fourth pounds per bushel. Grain about the same as best summer varieties. The wheat sown broadcast was turned under with a small turning plow, and harrowed. The land was plowed twice to the depth of thirteen inches.

It will be noticed that in these experiments the lightest seeding not only gave the largest yield of grain, but also the finest quality; and was by far the heaviest in weight. Mr. C. M. L. Andrews, Moscow, Michigan, in the fall of 1868, sowed the second yield of his Tappahannock wheat, in soil of moderate fertility, at the rate of one bushel per acre; and sowed Treadwell wheat in the same field, with like treatment, at the rate of one and one-third bushels per acre. The former ripened two weeks earlier than the Treadwell, and produced twenty-nine bushels per acre, while the latter produced but twenty bushels per acre. Considering all things connected with the crops, Mr. A. believes the difference was 100 per cent. in favor of the Tappahannock. In this case, as in many others, it is probable that some of the credit given by the experimenter to the newer variety of wheat is due to lighter seeding.

Mr. J. P. Nelson, New Berne, North Carolina, in November, 1868, sowed four and a half pints of Tappahannock wheat on one-half acre. The wheat was reaped and thrashed in June, 1869, and yielded seven and a half bushels. He says, "The wheat grew luxuriantly, and spread beyond anything I ever saw before. I counted, at harvest, forty stems with good heads of wheat from one root." Though this seeding was excessively light, being only five quarts to the acre, the yield was almost a fourth above an average.

Mr. Louis M. Booth, Knight's Ferry, California, in 1867, sowed thirty pounds of white Mediterranean wheat on three-fourths of an acre, and the yield was thirty bushels. This was equivalent to two-thirds of a bushel of seed, and a yield of forty bushels per acre. [The mode of culture, when omitted in this article, is not stated by the correspondent.]

Mr. Frederick Dwight, Agawam, Massachusetts, sowed the Arnautka spring wheat, in 1869, at the rate of a half bushel to the acre, and the yield was at the rate of thirteen and a half bushels, which is above the average yield per acre, notwithstanding the exceedingly light seeding for spring wheat.

Mr. Augustus Fendler, Saint Louis County, Missouri, sowed Excelsior oats, in 1869, at the rate of twenty quarts per acre, on bottom-land. They were sown April 9 and harvested July 14, and the rate of yield was forty bushels per acre, weighing fifty-one pounds per measured bushel.

Mr. Thomas Neele, Sandusky, Ohio, sowed the same variety of oats in 1869, in drills two feet apart, at the rate of forty pounds per acre. The ground was twice cleaned of weeds by hoeing. Birds and grasshoppers were very destructive to the crop; but the yield was at the rate of thirty-seven and one-fourth bushels per acre, by weight.

Mr. G. D. Wheeler, Deposit, New York, sowed the same variety of oats in 1869, at the rate of fifty-six pounds, or one and three-fourths bushels per acre, on bottom-land, which was manured and had produced corn the previous year. The product was a little over thirty-nine and one-third bushels per acre, by weight.

Mr. John Shaffer, Cumberland County, Pennsylvania, (whose experiment with the same variety of oats, in 1869, was furnished to the Department by Hon. R. J. Haldeman,) reports that he sowed very thin, and many of the grains produced ten stalks. The amount of ground is not given; but the yield, as stated, was at the rate of one hundred and thirty-six bushels for a bushel of seed, and the weight forty-five pounds per bushel.

Mr. D. C. Blackiston, Kent County, Maryland, reports that he sowed the Excelsior oats thin, in 1869, and that they branched so as to completely cover the ground. The yield was as 133 to 1.

Mr. C. T. Leonard, Ashtabula County, Ohio, sowed potato oats in 1870, in drills eight inches apart, upon newly broken ground. The yield was as 114 to 1, "of fine, large, white oats, far superior to any ever grown in this vicinity."

The Rocky Mountain News, Denver, Colorado, from which reports concerning wheat have heretofore been noticed, furnishes also records of experiments with three varieties of oats, as follows:

Excelsior oats, second year, from the Agricultural Department; four bushels sown on four acres; irrigated once; harvested two hundred and thirty-two bushels.

Swedish oats, two bushels on two acres; irrigated once; harvested one hundred and sixty-six bushels.

Norway oats, sown April 6, forty pounds to the acre; irrigated once; harvested July 20, yielding eighty-three bushels per acre.

Although not stated in the reports here quoted, it is probable that about the same quantity of oats per acre, both by weight and measure, was used in each experiment. A bushel of either variety would weigh about forty pounds, if they kept near the weight of the seed furnished by the Department.

In addition to the reports noted, many have been furnished to the Department, in which a much heavier use of seed is incidentally acknowledged. In a large proportion of cases, in which serious deterioration is noted, the cases are found to be those in which a superabundance of seed was used. While great benefits naturally arise from change of seed, as illustrated by our reports of tests, it may be safely concluded from the evidence of the same reports, as well as from experiments made for the purpose, that lighter seeding than is usually practiced by farmers generally would tend to greater yield and improved qualities of crop. It has been wisely remarked, in reference to farm-stock, that "feed, as well as breed," determines success, and the truism is alike applicable to plants. It cannot be expected, with reason, that land crowded beyond its physical or its nutritive capacity, with even the best seeds, will yield as healthy and abundant crops as if each plant had sufficient room and food from the beginning.

TOUZELLE WHEAT.

This is a beardless, white, winter wheat, procured by the Department at Marseilles, France; and hence it is classed as a Mediterranean wheat. There have been two importations—one of one hundred and forty bushels in August, 1869, and one of two hundred and thirteen bushels in January, 1870. A small distribution was made in Septem-

ber, 1869, chiefly through Senators and Representatives in Congress. Only few reports of experiments with this wheat have yet reached the Department. These are generally favorable. At Middleburgh, Loudoun County, Virginia, sown on good, well manured ground, at the rate of one bushel per acre, the yield was at the rate of thirty-three bushels per acre, and the product excellent.

At Waterford, Loudoun County, Virginia, sown on good soil, with ordinary care, it failed to fill, the season being dry. Tappahannock wheat in the same field did very well.

At Louisville, Pottawatomie County, Kansas, on upland prairie, eight years under cultivation, the yield was at the rate of twenty-six bushels per acre, weighing sixty pounds per bushel. Tappahannock, on the same farm, with similar treatment, yielded forty-two bushels per acre. The experimenter calls the Touzelle "very fine wheat."

At Shelbina, Shelby County, Missouri, one quart, on loam soil, with blue clay subsoil, yielded thirty-three pounds. It stood the winter well, and was harvested June 17. The straw was strong. The crop was injured by chinch-bugs, but the reporter says this wheat "bids fair to be a valuable acquisition."

At Red Oak, Cedar County, Iowa, one quart yielded "forty pounds of beautiful wheat, equal to the quart sent in whiteness and plumpness of grain." It stood the winter well.

At Chesapeake City, Cecil County, Maryland, on poor soil, without manure, it proved the best of five varieties sown. The report says: "The Touzelle is stiff and bright, the grain very plump and fine, the yield very good."

At Orleans, Orange County, Indiana, it gives great satisfaction. An experimenter writes: "It is all that I could desire. The grain is exceedingly large, with very stout and bright straw; no smut nor rust." Two men, one seventy-one and the other seventy-six years old, called it the best wheat they had ever seen. The reporter states that he could get $40 for the yield of the quart sown.

At Bellefonte, Centre County, Pennsylvania, as reported by H. N. McAllister, it failed to fill, though the straw was bright, and the grain looked thrifty. Tappahannock wheat, beside it, which did not promise nearly as well, turned out much better.

At Paducah, McCracken County, Kentucky, one quart yielded seventeen pounds of large, nice wheat. It stood the winter finely. Tappahannock did not do so well upon the same farm, yielding only nine and one-half pounds to the quart sown.

At Petersburgh, Dinwiddie County, Virginia, four quarts were sown by drill in squares of nine inches, two grains to a square, occupying nearly one acre of ground. The wheat was sown on the 10th of December, two months late, and got a slow start, but finally grew well, and covered the ground as if it had been sown broadcast. The ground was well fertilized with Peruvian guano. The wheat rusted badly, as did all grain in that vicinity, had to be cut before it was ripe, and was very much shrunk. The yield was six bushels from the four quarts. If the season had been favorable until maturity of the crops, the reporter thinks the yield would have been fully thirty bushels.

At Neosho Falls, Woodson County, Kansas, two quarts sown broadcast, at the rate of one bushel and a half per acre, on good upland prairie, "grew well, stood the winter first rate, had large but not well filled heads, and yielded three pecks of grain as nice and plump as the sample sown."

At Medina, Orleans County, New York, this wheat has been experi-

mented with two years by Mr. H. Bowen, has produced well, and is of excellent quality, though it is not quite hardy enough for that climate. Mr. B. thinks that if grown for a few years in States further south, as in southern Pennsylvania, Maryland, &c., it would become hardy enough to stand the more severe climate of Northern States, at least that of New York.

Hon. S. C. Pomeroy, Muscotah, Atchison County, Kansas, writes as follows:

The wheat sent me last year (four pounds) has been harvested here on my farm, and is now thrashed. It is the most perfect wheat I have ever seen. I have five bushels from that small beginning, the first year, and the product is fully equal to the seed sown. This was your importation of French (Touzelle) wheat of last year. The straw was long and bright. It was fully ten days later than any other wheat, and I find it a great advantage to have my wheat not all ripen at the same time. This wheat, I am sure, is invaluable for this section.

A correspondent in Lincoln County, North Carolina, states that two quarts of Touzelle wheat yielded three bushels and twenty-nine quarts, weighing fifty-seven and a quarter pounds per bushel, and that the grain would have been heavier if it had not been blown down while in the milky state, which caused it to shrink.

The Denver News reports one trial of this wheat in Colorado, stating that the crop was nearly destroyed by rabbits, but that what was saved proved to be excellent.

At Plymouth, Wayne County, Michigan, the straw of this wheat was small and tender, and lodged badly, and the kernel was shrunk. It proved later than the Treadwell wheat, but the yield was thirty-fold.

At Johnstown, Cambria County, Pennsylvania, twenty-eight pounds of seed yielded four hundred and eighty-seven pounds, and the quality was good; a measured bushel weighed sixty-five pounds.

At Paoli, Orange County, Indiana, this wheat was sown on rich clay soil, the last of October; stood a hard winter better than other varieties, and the yield from one quart, sown at the rate of one-half bushel to the acre, was one bushel, as good as the seed sown, and "as fine as ever was raised in Southern Indiana." The straw was bright, and solid half way from the head to the ground, so that there was no lodging.

At Little York, Washington County, Indiana, one quart was sown on light clay loam, in drills nine inches apart. The yield was thirty sheaves, from which twelve and a half pounds of wheat were thrashed. The wheat was badly damaged by black rust.

At Salamonia, Jay County, Indiana, the yield was thirty-six pounds to a quart of seed, and nineteen bushels twelve pounds to the acre. The grain is nice and plump, and of excellent quality. All smooth varieties except the Touzelle suffered from rust, many fields not being harvested on that account; but the Touzelle was entirely free from rust.

In Culpeper County, Virginia, three quarts sown on one-tenth of an acre yielded five bushels, weighing sixty-six pounds per bushel. It ripened June 1.

At Pleasant Home, Owen County, Kentucky, one quart yielded one peck. The grain was exceedingly fine and plump, and the straw heavy; a desirable variety for that section.

At Pompey, Onondaga County, New York, treated like the Treadwell wheat, with no extra care, the fall growth was heavy, and many of the plants were smothered. One-fourth of an acre, however, rich clover sod, top-dressed, yielded at the rate of fifty bushels per acre. The grain was very handsome; weight, sixty pounds per bushel.

At Cartersville, Cumberland County, Virginia, it proved very prolific; one quart yielded one bushel and twenty-eight quarts.

A supply of seventy-three bushels of this wheat was purchased for distribution by the Department, during the year, from the product of an experimenter in Orleans County, New York. The grain is in all respects equal to that sown.

TAPPAHANNOCK WHEAT.

The continued success which attends experiments with this variety of wheat, first distributed by the Department in 1862, indicates its great value as a contribution to the farming interests of the country. The results of only a few tests are given here. An experimenter in Oxford County, Maine, after a fair trial of this variety, thinks that it will prove just the kind needed for that climate, as it does not winter-kill, and gives a good yield.

In Rockbridge County, Virginia, it ripened ten days earlier than Lancaster wheat, and yielded twenty-seven bushels to the acre, weighing sixty-four pounds, while the Lancaster yielded less than fifteen bushels per acre. The stiffness of the straw enabled it to withstand storms. In Washington County, five quarts yielded four hundred and twenty-seven pounds—sixty-four pounds to the bushel. In Monroe County, West Virginia, on good soil, without manure, this wheat yielded a product considerably above the average, and ripened ten days earlier than other wheat; its short, stiff straw giving it a decided advantage over other kinds.

This wheat continues to be a favorite variety in North Carolina. In the opinion of a Lincoln County farmer it surpasses any other kind in use in that section. This variety and the "Walker" wheat are reported to be the only kinds raised in Jackson County to any extent; but it is claimed that the Tappahannock is 10 per cent. better than the Walker.

A Union County, South Carolina, correspondent states that the Tappahannock makes the best of flour. His wheat weighed sixty-six pounds to the bushel, struck measure, and yielded forty-five pounds of flour.

A crop of this wheat was raised in Moulton County, Alabama, which weighed sixty-two pounds to the bushel, yielding, on good sandy soil, twenty-two bushels per acre—treble the yield of varieties usually sown. It wholly escaped rust the first year, and the second crop, at the date of the correspondent's letter, gave promise of maintaining the reputation of the first.

A farmer of Sullivan County, Tennessee, reports that, although a bad season for wheat, by a little extra labor, and the application of sheep manure to very poor land, he raised twenty-four and one-quarter bushels to the acre. In Giles County this wheat is still the favorite variety.

In Laurel County, Kentucky, it is reported as ripening about one week earlier than other varieties.

A Greene County (Ohio) correspondent reports that he has twice harvested this wheat, and in neither case had it shown deterioration. It was about one week earlier than other varieties. In Shelby County, Tappahannock, sown the last of August, was ready to cut on the 10th of July succeeding—ten or twelve days in advance of the Lambert wheat, sown a few days before. In Carroll County there was a failure on account of rust. In Williams County this wheat yielded better than

any other variety. It was harvested June 18; other varieties about the 1st of July.

Reports from Indiana have been almost uniformly favorable. As far as tried, in Pike County, this wheat has proved a success in quantity and quality of yield, and is ten days earlier than other varieties. Favorable reports have been received from Cass and Sullivan Counties concerning the crops of 1871.

A correspondent reports from Marshall County, Michigan, the sowing of Tappahannock on land which had not been manured or specially prepared. It matured a week earlier than other varieties; the kernel was fine and plump, making the best quality of flour. Increase, twenty-fold.

Mr. C. E. Hollister, of Clinton County, states that from one pound of this wheat he harvested, the second season, thirty-five bushels of good wheat from one acre. Treadwell wheat, by its side, with the same treatment, yielded twenty-seven bushels per acre.

We have few reports of experiments in Illinois during the year, and these are not generally favorable. In Pike County it does not do so well as some other varieties. A similar statement comes from Edwards County. In Carroll County it failed, "not being sufficiently hardy to stand the severity of the winters."

In Stone County, Missouri, the Tappahannock is esteemed by many farmers as the best variety of wheat. At the Phelps County fair it took the first premium. In Newton County it has yielded thirty to thirty-five bushels per acre—one-third more than other varieties. Cole County reports twenty bushels per acre; quality, above average.

In Wapello County, Iowa, this wheat stood the winter well, and was about two weeks earlier in ripening than other winter wheat, producing a heavy crop with an exceedingly fine kernel.

As far as tried in Wyoming Territory this wheat promises very satisfactory results.

The Kansas Farmer says that, among the many valuable contributions of seeds made by the Department, none are more valuable than the Tappahannock wheat, and urges upon farmers the propriety of securing some of it for seed for another crop. Mr. O. W. Bill, of Riley County, reports a yield of thirty-six bushels to the acre, the grain being of the very best quality.

ARNAUTKA WHEAT.

Concerning this excellent variety of spring wheat, imported from Russia by this Department in 1866, the most favorable accounts continue to be received. The desirable qualities of this wheat have been stated at length in former annual reports. In Rockingham County, Virginia, it yielded at the rate of twenty-five bushels per acre, the product being of a superior quality. The seed is said to be in great request among the farmers of the county. Favorable accounts have been received from Burnett and Pierce Counties, Wisconsin; in the latter, this wheat yielded one-third more than other spring varieties, planted on similar soils. A correspondent relates that in Faribault County, Minnesota, after a trial of two seasons, the Arnautka continues to do well, being superior to other kinds of spring wheat, and not liable to fall in high winds or wet weather. In Marshall County, Iowa, it yielded at the rate of thirty-five bushels per acre. In Otoe County, Nebraska, the growth was luxuriant and strong, and the yield large. It also did remarkably well in Dixon County. In Clark County, Washington Ter-

ritory, twenty-five pounds of the Arnautka yielded two hundred and ten pounds of "beautiful wheat," ten days earlier than any other variety produced in the same section. A correspondent at Coldwater, Michigan, states that, after carefully experimenting, he has concluded that this wheat is not adapted to that section of the State.

OTHER VARIETIES OF WHEAT.

A farmer of Floyd County, Georgia, states that he can raise forty to fifty bushels of Polish wheat per acre on good fresh upland, well manured and thoroughly worked. This variety was introduced by the Department in 1868, but does not seem to be adapted to the country generally, according to the reports received from different sections.

Saissette wheat was imported from France in 1870, and largely distributed; but few returns, however, have been received as to experiments made. In Mecosta County, Michigan, the yield and quality compare favorably with the best varieties, and the wheat is about two weeks earlier in ripening than the kinds usually sown.

The following statement in regard to a new variety of wheat distributed by the Department during the current year is taken from the monthly report for August and September:

> A new and very promising variety of wheat, called the Fultz wheat, is attracting considerable attention in Mifflin, Juniata, Lancaster, and neighboring counties, in Pennsylvania. It is nearly smooth, with beards occasionally; is very evenly six-rowed; the straw stands well, the chaff very close and adherent; and it is claimed that it has never been affected by weevil; the grains are short and plump, and in color a light dull red or dark white. The Department of Agriculture has distributed a quantity of this wheat, and as the variety will be likely to receive an extended trial the coming year its alleged history will prove interesting. It is stated that in the summer of 1862 Mr. Abraham Fultz, of Mifflin County, Pennsylvania, while harvesting some old Lancaster red wheat, noticed three beautiful heads of smooth wheat. He took these heads home, and in the fall sowed the wheat on a spot where a brush-heap had been burned. The following summer he harvested half a pint. In 1864 his crop filled a basket, and in 1865 he had nineteen sheaves. Mr. Fultz then parted with a bushel of the wheat to Christian Detweiler, who sowed it along the northwestern side of an old orchard, where it was partly smothered by snow-drifts and shaded by apple-trees. In the harvest of 1866 it was pronounced "scarcely worth sowing," but when thrashed it was found to yield better than the favorite Lancaster red. Mr. Detweiler again tried it, and the next year, from about three acres of sandy land, he harvested ninety-four bushels of prime clean wheat; and the following year, from thirteen bushels, sown on nine acres, he harvested three hundred bushels. The yield with other parties has been thirty to thirty-five bushels to the acre. The highest yield reported is by Mr. Emanuel Kauffman—one hundred and eighty bushels on four acres. This wheat makes an indifferent show above ground in the fall and early spring, but it makes up when harvest comes by its splendid straw, fine heads, and plump grains. The Department has already distributed all that it had at disposal.

The following statement of experiments with different varieties of wheat is taken from the report of the board of trustees of the Agricultural College of Pennsylvania. The experiments were conducted on the eastern farm, in Chester County. The star (*) indicates the varieties introduced or distributed by this Department:

There was no wheat sown in the fall of 1869 in exact accordance with the prescribed programme, as we had not the previous preparation of ground to work upon; but we have taken through a number of experiments, as follows: On land of about uniform quality, cultivated and manured all alike, we planted four square perches of each of the following kinds of wheat to test their relative merits, time, and thickness of seeding, &c.:

Number.		Planted.	Cut.	Produce, in sheaf.	Produce, by measure.	Weight per bushel.	Sowed per acre.
		Month.	*Month.*	*Lbs.*	*Qts.*	*Lbs.*	*Qts.*
1	French White Chaff, Mediterranean	15th of 9th	7th of 7th	118	14¾	60¼	60
2	Rue's or Prolific Amber	do	do	114	14½	60¼	60
3	Ancona Red	16th of 9th	8th of 7th	90	10 1-16	56¾	60
4	Old White Chaff, Mediterranean	do	do	98	13¼	60¾	60
5	Russian Amber	do	do	104	15⅝	59¼	60
6	White Chaff, Mediterranean, from late imported seed	do	do	99	14½	58	60
7	Brittany	do	do	109	15¼	60	60
8	Witter	do	do	86	11	58½	60
9	Italian Red	do	do	87	11	58¾	60
10	Treadwell	do	8th of 7th	92	12½	60	60
11	Rough and Ready	do	6th of 7th	114	16	58¾	60
12	Shade Mountain White	do	8th of 7th	88	7¾	57½	60
13	American White	do	do	103	9¾	57¼	60
14	Weeks's White	do	6th of 7th	101	14	60	60
15	Tappahannock*	do	30th of 6th	102	16⅞	61¾	60
16	Early Jersey	do	do	96	15 1-16	61¼	60
17	White Blue Stem	do	do	110	16⅔	62½	60
18	Oceana	do	9th of 7th	88	7	56½	60
19	White Tonzelle*	20th of 9th	7th of 7th	82	5¼	52	60
20	Italian White	17th of 9th	do	75	8⅝	57	60
21	California White	18th of 9th	do	80	7 1-16	54½	60
22	Rough Chaff*	20th of 9th	9th of 7th	90	7	56	60
23	Talavera*	do	do	88	11	56½	60
24	Tappahannock*	2d of 10th	30th of 6th	80	11⅝	62¼	140
25	Sandonica White	18th of 9th	8th of 7th	96	9¾	60	60
26	Diehl	do	7th of 7th	77	8¾	54¾	60
27	Extra Early Georgia	30th of 9th	30th of 6th	64	9⅞	60¾	60
28	Old Red Chaff. Mediterranean, in rows 16 inches apart, and cultivated	2d of 10th	7th of 7th	69	9¼	59¼	30
29	German Amber	18th of 9th	do	99	13½	59½	60
30	Berdenska Red	do	do	81	6½	60¾	60
31	Hungarian Red	do	do	76	6⅝	61¼	60
32	Bohemian Red	do	do	98	8⅜	57¼	60
33	Lancaster Red	20th of 9th	do	101	14½	60	60
34	Sulla Red	do	8th of 7th	84	8¼	57	60
35	Sakonka Red*	do	do	76	5 1-16	58¼	60
36	French Red Chaff	do	6th of 7th	113	15½	60¼	60
37	Rochester Red, (see note)		8th of 7th	......	......	......	.....
38	Old Red Chaff. Mediterranean, in rows 16 inches apart, and cultivated	2d of 10th	7th of 7th	81	11	59½	60
39	Michigan Amber	30th of 9th	8th of 7th	74	7¼	59	60
40	Sharpless	do	do	92	14⅞	58	60
41	Long Bearded, (foreign)	2d of 10th	10th of 7th	......	......	......	.....
42	Chili Club	14th of 10th	do	......	......	......	.....
43	White Australian*	do	do	......	......	......	.....
44	Tappahannock*	2d of 10th	30th of 6th	86	13¾	62½	100
45	Tappahannock*	do	do	86	13¾	62¼	60
46	Thirty kinds of seed mixed, (2d year)	20th of 9th	8th of 7th	98	12½	59	60
47	Old Red Chaff Mediterranean	do	7th of 7th	116	15 1-6	61	60
48	Old Red Chaff Mediterranean, (1870)	29th of 1st	9th of 7th	31	7	58	60
49	Old Red Chaff, Mediterranean, (1869)	2d of 10th	7th of 7th	95	11⅓	59¼	60
50	Italian White Chaff, (bearded)	28th of 9th	6th of 7th	60	9 4-15	60¼	.....

The preceding plots were put in with the hand-drill, one row at a time. This, and occasional showers of rain, caused the prolonged time of seeding. We this year abandoned the little drill, and sowed broadcast seventy-five kinds of wheat within two days.

The careful observer may see the results of planting at different times, and different quantities of seed, in Tappahannock, Nos. 15, 24, 44, and 45; and also in Red Chaff Mediterranean, Nos. 47, 48, and 49, different seasons; 48 was not intended to be so late, but freezing weather setting in unusually early prevented working the ground. It came up in the spring, did not have time to tiller much, was thin on the ground, and of small size; but it bloomed late, after the rainy season was over, and the heads were more regularly filled with live grains of wheat than those put in at the usual time. And by comparing Nos. 28, 38, and 49 may be seen the same kind of wheat put

in the same day, but in different ways; No. 49, the rows the usual width, eight inches apart, and seed sixty quarts to the acre, and no cultivation; No. 38, rows sixteen inches apart, seed sixty quarts to the acre, same as 49, but double quantity in each row, and cultivated in the spring; while No. 28, the rows sixteen inches apart, seed thirty quarts to the acre, equally thick in the row with 49, but only one-half the number of rows in the plot, cultivated same as 38.

EXCELSIOR OATS.

This variety of oats, imported from England by the Department in 1868, continues to give thorough satisfaction to the farmers of the country. As stated in the annual report for 1870, and confirmed by repeated experiments, they are superior to the varieties usually sown, in weight, yield of grain, and adaptability to a great diversity of soil and climate.

A correspondent writing from Waldo County, Maine, states that he has tried the Excelsior oats for two years, and they have done exceedingly well, the product weighing forty pounds to the bushel. Mr. Levi Bartlett, of New Hampshire, states that in the spring of 1869 he sowed a peck of this variety, which, owing to severe droughts, yielded only a little over five bushels. The next season, also one of severe drought, he sowed one bushel and harvested thirty bushels. Having experimented with six or eight varieties, Mr. Bartlett considers the Excelsior oats the best, the weight especially considered. This gentleman writes:

Till recently the legal weight of oats for this State was thirty pounds per bushel, but now thirty-two pounds are the standard weight. From inquiries at several of our stores, I learn that thirty-two pounds are a fair average weight for our old sorts, that have been grown here time out of mind. In 1869 my Excelsior weighed forty pounds per bushel; in 1870, thirty-eight pounds; in 1871, forty-three pounds; Australian, forty pounds, and Arctic, thirty-eight pounds.

A correspondent, writing from Chittenden County, Vermont, states that in a good season these oats will weigh forty pounds to the bushel.

In Middlesex County, Massachusetts, these oats, in yield and quality, were superior to any other kinds.

In Erie County, New York, two quarts of this variety, on one-tenth of an acre of gravelly land, well manured, yielded four bushels, notwithstanding the rust and grasshoppers. Mr. L. M. Rogers says in regard to an experiment with four pounds of this variety of oats:

The soil on which they were sown was a clay loam that had been in corn the previous year. No manure was applied, except what was put in the hills for corn; I intended to give them only ordinary culture—no better chance than every good farmer would give his oat crop; but, as it was, they did not have even this. A cold, wet spell coming on soon after they were sown, so retarded their growth that the sorrel and other weeds rather got the start. Being sown broadcast, it was inconvenient to pull this out, and it must have somewhat diminished the yield. They ripened several days earlier than common oats sown at the same time, and yielded one bushel and eighteen quarts of fine grain, weighing thirty-nine and one-fourth pounds per bushel. This would be about fifteen pounds from one. Taking into consideration the fact that common oats were not more than half a crop in this section, and would not weigh more than twenty-eight pounds per bushel, I think the Excelsior promise well. The only fault I have noticed is their liability to lodge.

In Sullivan County the yield was forty-five bushels per acre; straw one ton.

In Cecil County, Maryland, the Excelsior grew the tallest, weighed the most per bushel, and gave the greatest yield of all varieties tried, ripening earlier by a week. Our correspondent considers them the best quality of oats for that section.

In Fauquier County, Virginia, on clay and gravel soil, the yield per acre is stated at fifty bushels; weight per measured bushel, twenty-six pounds.

The secretary of the Farmer's Club of Peoria County, Illinois, says:

The Excelsior oats sent me two years ago are beginning to attract more attention than any oats ever grown here. They withstood the blighting of drought remarkably well. They have passed through two extremes of wet and dry, and if the present season is such as the majority of farmers anticipate, a very fruitful year, their characteristics will have been fully tested.

Mr. Edward H. Knight, of Logan County, Ohio, bears the following testimony as to the value of this variety of oats:

About three thousand bushels of Excelsior oats have been raised in my vicinity this year from the proceeds of the package you sent me a few years ago. They continue to weigh well, and the straw, cut in time, is abundant and excellent, and of no mean additional value.

A farmer in Tuscarawas County raised seventy bushels per acre in the season of 1870, with no falling off in weight.

Mr. A. S. Hatch, of Richland County, Wisconsin, states that his Excelsior oats weighed fifty pounds per bushel. He pronounces them to be the best ever introduced in that section.

A Jefferson County, Kentucky, correspondent says that one quart of Excelsior yielded sixty-seven pounds of oats much superior to any other variety with which he is acquainted, especially in strength of straw, which kept them standing until harvested, and plumpness of grains, which more nearly resemble barley grains than those of the ordinary oats. In Marion County, Oregon, these oats are pronounced superior, and well adapted to the climate. They ripen ten to fourteen days earlier than other varieties, and the yield excels in quality and quantity.

Mr. S. S. Fenn, of Nez Perces County, Idaho, states that he received a quantity of Excelsior oats in 1869 for distribution, and although planted late in the season, they proved to be a very great improvement upon the old varieties. Mr. J. P. Schepter, at Lake Moha, eighteen miles from Lewiston, sowed on the 1st of June two and a half pounds, and harvested one hundred and seventy-nine pounds. In 1870 he sowed the one hundred and seventy-nine pounds upon two acres of ground, and harvested one hundred and ninety-four and a half bushels, weighing forty-nine pounds to the bushel. The ground was irrigated, and special pains were taken with the crop. Another farmer sowed a small quantity in 1869, from the product of which in 1870 he sowed an acre, and harvested seventy-nine and a half bushels, weighing forty-nine pounds to the bushel. The crop was raised on high and dry ground, without irrigation. This correspondent states that of the common varieties raised in that section, sixty bushels, weighing thirty-four pounds to the bushel, have been considered an excellent yield when raised without irrigation.

WHITE SCHÖNEN OATS.

This variety of oats, imported from Germany by the Department, and first distributed in 1868, continues to be a favorite in many sections of the country. In Penobscot County, Maine, a quart sowed in 1869 yielded at the rate of forty bushels per acre, weighing thirty-eight pounds to the bushel. In 1870 the yield was forty-eight bushels per acre, and weight forty-one pounds per bushel. In Belknap County, New Hampshire, one quart yielded one and one-eighth bushel of good heavy grain.

A Macon, Georgia, correspondent says the white Schönen did tolerably well, but they are subject to rust, and therefore not so suitable to

that section as oats known as rust-proof. Mr. W. Spillman, of Clarke County, Mississippi, writes:

I sowed four pounds of white Schönen oats on one-ninth of an acre of land fertilized with ten bushels of cotton-seed. The soil was flat, pine-wood land. Yield, four bushels, weighing a little over forty pounds to the bushel. I think the yield would have been one-third more but for the frequent heavy rains at the time the oats were in bloom. Some rust appeared on the blades. The straw was bright and smooth. I believe these will prove good oats for this part of the State.

In Ashland County, Ohio, one pint of white Schönen yielded two and a half bushels on four square rods, being at the rate of one hundred bushels per acre. The two and a half bushels sowed in 1870 yielded one hundred and one bushels. They are highly prized in that portion of the State.

In Orange County, Indiana, this variety yielded at the rate of fifty bushels; heads long and straw very stout. In Carroll County, one quart sown broadcast on sandy clay soil, produced forty-six pounds of extra oats.

An average yield of sixty bushels per acre is reported from Lancaster County, Pennsylvania. Allamakee County, Iowa, reports a yield of eight hundred and ninety-seven bushels from thirty bushels planted; weight of grain, forty pounds to the bushel.

A correspondent, writing from Cottage Home, Lincoln County, Nebraska, states that he sowed one-half gallon white Schönen oats, broadcast, on the 15th of March. The soil was sandy, with yellow clay bottom. No manures were used. Yield, one bushel of clean grain and thirteen sheaves of straw; weight of grain, forty-three and one-quarter pounds. It was sown too late for the climate and season, and was somewhat injured by rust. This variety yielded 42 per cent. better than the Swedish, 47 per cent. better than the Norway, and 50 per cent. better than the common black oats. They grew six feet high, with a heavy foliage, the heads averaging seventeen inches.

A Galveston, Texas, paper, says:

We have before us a number of stalks of the White Schönen oats, grown upon Galveston Island, which measure four feet in length, and have the broadest leaf and heaviest head we have ever seen in this grain. It is further remarkable that the specimens before us are from seed planted on the 14th of February, and were ripe for cutting on the 23d of May. From the product before us, we are inclined to believe that this new variety of oats is well adapted to our State and climate.

Mr. F. Z. Palmer, Shasta County, California, sowed a pound of white Schönen on good ground, one rod wide by two rods long, or at the rate of eighty pounds to the acre, and reports that, although they suffered somewhat from drought which prevailed throughout the State, the yield was fifty-six pounds, or one hundred and twenty-four and four-ninths bushels to the acre, weighing thirty-six pounds per bushel.

This variety is claimed to be well adapted to the soil and climate of the Umpqua Valley, Oregon. A farmer of Douglas County states that a quart received from the Department yielded thirty-five pounds, or at the rate of seventy bushels to the acre; weight, fifty pounds to the bushel.

POTATO OATS.

These oats yielded, in Onondaga County, New York, under unfavorable circumstances, fifty bushels per acre, thirty-six pounds to the bushel. In Wabash County, Indiana, they yielded well; weight, forty-five pounds per bushel, although somewhat damaged by drought. In Elkhart County, from a second sowing of one quart, twenty-one quarts

were raised, at the rate of fifty-three bushels per acre. Other oats in similar soil yielded forty bushels per acre. Favorable accounts have been received from other sections concerning the value of these oats, as also concerning the Surprise oats.

Mr. Henry H. McAfee, farm superintendent of the University of Wisconsin, reports as follows concerning experiments with oats:

White Schönen oats lodged badly, but produced 78.07 bushels per acre; weight per bushel, 30.50 pounds. This was the largest yield on the farm this year, (1871,) and compares with other varieties tested as follows. Those marked with a star are varieties distributed by the Department:

Varieties.	Weight per bushel.	Bushels per acre.	Per cent. of grain.	Per cent. of straw, &c.
White Schönen *	30.50	78.07	36	64
Surprise *	38.00	75.12	51	49
Common white	34.75	62.25	39	61
Ramsdell Norway	32.00	65.25	41	59
White Norway *	33.49	50.32	36	64
Potato *	34.50	47.18	20	71
Bohemian, (without hulls)	40.50	30.30	16	84

BARLEY.

Among the several varieties of barley distributed by the Department, the Chevalier and the Thanet, the latter a new variety, seem to have given very general satisfaction. Mr. C. H. Sweet, of Onondaga County, New York, says, in regard to two varieties tested by him:

The first Saxony barley received from the Department was planted in the spring of 1870, and yielded thirty bushels to the acre, the conditions being unfavorable. The product was planted in the spring of 1871, and the yield was a trifle less than sixty bushels per acre. * * * * * * One experiment with Chevalier barley was made precisely the same as with the Saxony; the yield was a little larger, grain a shade better. Barley raised by me heretofore yields about forty bushels per acre. The Chevalier took the premium at our county fair.

In Bremer County, Iowa, the Chevalier yielded at the rate of sixty bushels per acre.

In Esmeralda County, Nevada, the Brewers' Delight yielded seventy-two and one-half bushels from one acre, carefully cultivated. The crop would average forty bushels to the acre. A correspondent in Lassen County, California, says that the Beardless Barley yielded 20 per cent. more than the varieties common to the county.

In Wright County, Iowa, Thanet barley yielded a little over the average, the kernel being larger and finer than of other varieties. This variety has also succeeded well in Clayton County, and a correspondent writing from Boone County, pronounces it superior to any variety ever raised in that part of the country. In Rockland County, Wisconsin, this barley produced a crop about equal in quality to the seed sown. The product in Richland County, Ohio, was seventeen-fold, notwithstanding a severe drought.

The secretary of the Farmers' Club of Marion County, Iowa, notes a yield of forty bushels per acre of the Chevalier, and thinks that, with proper cultivation, sixty bushels could be obtained. He adds that this barley is pronounced superior to any other kinds grown there. In Chemung County, New York, common barley weighed forty-nine pounds per bushel, and Saxonian fifty-six.

In Woodford County, Illinois, the Saxonian was tried on four kinds of soil, and did best on clay, but owing to drought it produced only half

a crop. It is said by the correspondent to be a fine variety of two-rowed grain, and that it was pronounced by an experienced brewer to be very superior for brewing purposes. In Ottawa County, Michigan, two quarts of this barley produced two and one-half bushels. It ripened early, and is commended as well suited to that climate. In Millard County, Utah, it was planted late, but did well, beyond all expectation.

We append the results of experiments on the central farm of the Pennsylvania Agricultural College, those varieties marked with a star (*) having been distributed by the Department. The plots contained one-eighth of an acre each, excepting the two numbered 535, which contained one thirty-second of an acre each. The seeding was at the rate of one bushel per acre:

No. 523. *Probstier.**—Sown, April 23; cut, July 24; housed, August 5. Product in straw, 240 pounds; in grain, 70½.

No. 524. *Saxonian.**—Sown, April 23; cut, July 15; housed, August 5. Product in straw, 230 pounds; in grain, 64.

No. 525. *Common four-rowed.*—Sown, April 23; cut, July 10; housed, August 5. Product in straw, 390 pounds; in grain, 122½.

No. 526. *L. E. Rottingham.*—Sown, April 23; cut, July 23; housed, August 5. Product in straw, 240 pounds; in grain, 49.

No. 527. *Golden melon seed.*—Sown, April 23; cut, August 1; housed, August 5. Product in straw, 340 pounds; in grain, 96.

No. 528. *Chevalier.**—Sown, ——; cut, ——; housed, ——. Product in straw, 290 pounds; in grain, 109.

No. 535. ¼ *2-r'd barley.*—Sown, May 11; cut, August 1; housed, August 15. Product in straw, 33 pounds; in grain, 9.

No. 535. ¼ *6-r'd barley.*—Sown, May 11; cut, August 1; housed, August 16. Product in straw, 36 pounds; in grain, 8.

No. 529. *Brewers' Delight.**—Sown, April 23; cut, July 25; housed, August 5. Product in straw, 340 pounds; in grain, 113.

VEGETABLES.

Returns of results of experiments with vegetable seeds, sent from the Department, have been made from nearly all parts of the country. A few examples only, however, are selected from the mass reported.

Beans.—A correspondent in Tuscola County, Michigan, reports the Early Rachel bean a valuable acquisition. Another, in Greenville, Alabama, describes it as the finest bearer he ever saw. He used them for eight weeks in succession, from the planting of one package of seed. The French bean bears well in Texas, and is fit for the table in six weeks from planting.

In Hampton, Virginia, the Concord horticultural bean proves second to the Lima only. In Minneapolis, Minnesota, Fulmer's forcing bean is extra early and extra good. The Feejee is a coarse, hardy variety, very prolific, and stands summer heat admirably. Negro beans, planted April 27, in Dover, Kansas, were fit to cook June 20. The correspondent pronounces them the best beans he ever saw. In Richland County, Wisconsin, the African black beans were extraordinarily prolific; every plant being loaded down with pods.

Beets.—The Bassano and flat Egyptian beets have been reported on favorably from many sections. Dewar's beet is pronounced very good.

Mangel Wurzel.—In Jackson County, Iowa, many single roots weighed twenty-four pounds each. The University of Wisconsin reports them not large, but very smooth. In Lake County, Minnesota, they were a splendid crop; many tried them, and all were well pleased. In Hampton County, Virginia, long blood, extra early, Bassano, and Carter's extra oval-shaped mangold beet, all grew well and appear to be well adapted to this climate.

Cabbage.—The cocoa-nut cabbage in Jackson County, Ohio, is reported to be extra fine; good to use August 20. In Riley County, Kansas, the heads grew solid and small; and in Minneapolis, Minnesota, they grew very hard and good. Brunswick cabbage in Bastrop, Louisiana, is doing finely, some of the heads "weigh eight to ten pounds, and stand the winter well."

Corn.—The Peruvian Caraqua corn proved worthless, except for stalks, in Virginia, Texas, Kentucky, and South Carolina. The Excelsior Sugar-corn produced the earliest roasting-ears in Boyle County, Kentucky. The correspondent writes that he had corn to eat the 1st of July, a very unusual thing in that latitude. In Tuscola, Michigan, it grew finely and was usually good in quality.

Celery.—Seely's Leviathan White Celery is pronounced a splendid variety for the climate about Saint Louis, Missouri.

Cucumber.—New Jersey hybrid, planted April 20, in Hampton, Virginia, was ready for the table July 1, uniform in size and of excellent quality. In Liberty County, Georgia, it grew to a very great size, the largest measuring fifteen inches in length, and many reaching thirteen inches; flavor excellent.

Lettuce.—Large white butterhead lettuce grew finely in Clarke County, Kentucky; sown March 11, it was fit for use April 20. In Sullivan County, Tennessee, it was very early and good, but failed to mature. In Camden County, Georgia, it was fine, free from the strong bitter taste of other curled leaf varieties. In Blount County, Alabama, it proves a valuable variety; and in Le Roy, Kansas, it is pronounced the best ever seen there—tender and sweet. In Shawnee County, Kansas, sown April 3, it was fit for use May 7, and the best of six varieties grown.

Onions.—The Madeira onion in Fauquier County, Virginia, produced a fine growth, very delicate in taste. In Hamilton County, Ohio, the early red onion grew very large from seed, larger than from sets; the Strasburg onion did not do so well. In Queen Anne County, Maryland, the latter variety grew three inches in diameter; and in Dallas County, Iowa, it grew very large and matured early. In Sullivan County, Tennessee, the Danvers yellow matured a good crop of fair quality, but did not keep well. Bulbs as large as a tea-cup were made in Coryell County, Texas, by August, from seed planted in March. The Deptford onion produced very large bulbs, and very sweet, in Jefferson County, Kansas.

Parsnips.—Highly satisfactory reports concerning the Student Parsnip have been received from Iowa, Wisconsin, Maine, Connecticut, North Carolina, and other States.

Opium poppy.—The University of Wisconsin reports a yield of eight hundred and six and two-thirds pounds of seed to the acre. No attempt was made at collecting opium. In Sonora County, California, the experiment was a success, so far as establishing the fact that the opium poppy will grow and do well in that part of the country; but our correspondent expresses the opinion that the high price of labor in California may prove an effectual barrier to its cultivation.

Peas.—Carter's first crop ripened for use two weeks earlier than other varieties, in De Loz, Nebraska; and in Franklin County, South Carolina, they produced a fine crop. In Brook Haven, Mississippi, they are pronounced a splendid variety, two weeks earlier than others. Of the Excelsior marrowfat peas a correspondent in Leetown, Virginia, says, "Only superlatives can describe its excellencies." In Knox County, Illinois, planted April 17, they were ready for use June 22; not quite so large as ordinary marrowfats, but superior in flavor. American Tom Thumb peas were prolific and of excellent quality in Lancaster County, Pennsylvania.

McLean's Little Gem, very early in Tamworth, New Hampshire; fit to cook in eight weeks from planting; good yield. Champion of England pea was superior in flavor to any other for table use in Dutchess County, New York. Veitch's Perfection matured in Jefferson County, Kansas, about the same time as the common varieties; grew very large and of superior quality. In Sullivan County, New York, they are stated to be the best ever known there, yielding two crops in the year, and in product and quality better than other varieties.

Tomatoes.—In Tuscola, Michigan, the Tilden tomato proves especially successful. The General Grant tomato, a fine, large, and smooth, and quite early variety, maintains its excellence wherever tried. It is a good bearer, and superior in quality. The French seed tomato proves to be of fine flavor, but small; in many respects it resembles the Tilden.

Turnips.—A Georgia correspondent writes that Carter's improved yellow hybrid purple excelled all varieties he has ever grown. Some of the roots attained a diameter of six inches, the tops covering a diameter of three feet. This is considered the most desirable variety for that latitude. The Yellow Dutch and Carter's globe for fall sowing did well. Carter's white six weeks turnip grew very good and sweet in Camden County, Georgia. Carter's improved hardy Swede was also excellent, larger than the other varieties. This variety proved satisfactory in many sections from which reports have been received.

EGYPTIAN COTTON.

In the year 1866, the Department received through Mr. Hale, then consul of the United States at Alexandria, a supply of Egyptian cotton-seed, for the purpose of testing its adaptability to the soil and climate of the cotton-growing regions of this country. It will be seen by the appended experiments that thorough tests have been made in most of the cotton-producing States. The results, however, have not been favorable. From the black, naked seed, and the general appearance of the bolls, it appears to be a species of the sea island cotton, finer in quality and longer in staple than the common upland, but not so fine nor so long as the true sea island.

Thus far no experimenter has noted the Egyptian as superior to the sea island usually grown in this country, but several, on the other hand, describe it as essentially inferior.

In Stanly County, North Carolina, this cotton grew thriftily, forming a large high bush, full of yellow blossoms and a deeply divided foliage, which remained green when everything else around it was withering; when other varieties had yielded nearly all their crop, the abundant bolls of the Egyptian cotton hung green on the stalk. Only a few bolls opened fully ripe, amid a large proportion of faulty and decaying ones. Those that ripened yielded a long snow-white lint, finer than silk, out of which, being picked by hand, the women spun a very slender thread, without much previous preparation. The bolls, though numerous, were smaller than those of the other varieties, and contained but three partitions to the boll. The contents of one hundred bolls were one-fourth lighter than the product of the same number of other kinds. In Chowan County it grew beautifully, but was at least fifteen days later than other varieties, and did not bear more than one-third as much as the Peeler cotton. In Duplin County, did not yield one-fourth as much as ordinary cotton. Craven County, not profitable, unless it will sell for at least 50 per cent. more than ordinary cotton. Hertford County, not suited to the climate. Newbern County, valueless as a field crop.

Randolph County, on mulatto clay soil, twelve hundred feet above the sea, the plant grew three to six feet high, with the average number of bolls; bloom, yellow; bolls smaller than those of common variety, and inclined to be long and tapering; lint of rather yellow tint, but very fine; planted earlier it might do better. Gaston County, stood the drought better than other varieties, remaining green and fresh, while others were dying. In Guthrieville, South Carolina, it fruited well and resisted the drought, but the fruit was entirely too late. Wilkinson and Georgetown Counties, it developed no advantages. Barnwell County, stalks grew large before making, but it makes rapidly and grows in the dryest season, when other cotton ceases to grow or sheds its bolls; it is the last to be attacked by the cotton-worm; a small patch yielded at the rate of one and a half bales to the acre. In Walton County, Georgia, it is deemed of little value, the fruit being entirely too small and too late to mature. Butts County, declared to be a poor variety of sea island cotton, not adapted to the latitude. Macon County, it proved almost worthless, yielding less than fifty pounds on land that would produce six hundred to seven hundred pounds of common cotton. Wilkinson County, unsuited to the climate; the growth was equal to that of other cotton, but the yield was very poor. Jackson County, a failure. Burke County, it produced a fine staple, but it would not pay to cultivate. Harris County, a fair staple, but did not fruit well; bolls small; about half a crop. McDuffie County, did not yield twenty pounds of lint per acre where Prolific will yield four hundred pounds. Stewart County, all the plants fine; some yielded well, others very little fruit. In Clarke County, Mississippi, it is found unsuited to the climate, the season being too short. Kemper County, the leaf grew large and the flower yellow, but the plant was too stalky, and bore very little fruit. Winston County, Mississippi, three weeks later than common cotton; too late for bolls to mature. Coahoma County, a failure. Clarke and Holmes Counties, not suited to the climate. Newton County, stalks would have grown fifteen feet high had they not been topped to hasten maturity; lint of extraordinary length, strength, and fineness. Bolivar County correspondent thinks if checked four feet each way it would produce well, not grow so tall, and have more branches. New Orleans and Memphis cotton merchants pronounce the lint fine, but say that it cannot be ginned on common gins, as they cut the lint badly. In Clarke County, Alabama, it is too late, and not nearly so prolific as the common cotton. Calhoun County, a failure. Randolph County, did well, considering the drought; stalks five to six feet high, averaging twenty bolls each; common cotton two to three feet in height. In Rapides Parish, Louisiana, in one trial it developed no real value. East Feliciana Parish, comparatively worthless. Carroll Parish, on poor land it stood the drought without losing a single boll; on rich land it grew very rank and averaged one hundred bolls to the stalk, but they were too late to open. Saint Mary's Parish, it grew tall, straight, and very stiff; blossoms large and numerous. Brown Parish, staple very much like sea island; an excellent quality of cotton. In Phillips County, Arkansas, the growth was luxuriant, so rapid that the main stalk was topped; it formed well; no squares or forms putting off as on other cotton; lint very fine; while others in the vicinity think it a failure, this correspondent does not, as yet. La Fayette County, perfectly satisfactory; yielding an abundant staple, long, fine, and silky. In Dinwiddie County, Virginia, it bloomed too late; no bolls opening before December.

SOUTHERN FRUIT-GROWING FOR MARKET.

Fruit production in the South for market is a subject of special public interest, whether considered as a source of food supply to our growing population, or as a promising diversification of the agricultural industry of that region. The remarkable results that have sprung from superficial and imperfect culture, in many cases, demonstrate a peculiar adaptation of soil and climate for this branch of agricultural enterprise, and for a large and varied production of the most remunerative character. The development of these resources is important to the whole country, and especially to that portion of the Union lately devastated by civil war. The subject has occupied the special attention of this Department for several years, and efforts have been made to collect reliable facts illustrating the actual *status* and the capabilities of southern fruit-culture. Circular letters have been addressed to all the fruit-culturists in the South whose names and localities could be ascertained, requesting specific information in regard to their individual enterprises. The result of this effort has been the accumulation of a mass of local facts in regard to the culture of different kinds of fruit, from which it is proposed to select points of marked interest. Some of our correspondents appear to have misunderstood the purpose of our inquiries, and instead of sending specific replies, have returned elaborate treatises, of which we are able to make but a limited use. It would give us pleasure to publish some of the more valuable of these contributions, but the pressure of matter upon the space of this report will permit only a brief *résumé.*

DELAWARE.—In this State, our reports show a great preponderance of peach culture. In Kent County alone, according to the statement of our regular correspondent, Mr. Hayes, of Dover, there are 10,600 acres planted in fruit trees, mostly peach. Apple culture dates back to a very early period. Pear culture has become common only within five or six years. It is estimated that 800,000 peach trees, 20,000 apple trees, and 15,000 pear trees are in full bearing. The average yield of peach trees, planted sixteen to twenty feet apart, is about one hundred baskets per acre, sometimes rising to five times that amount. Of the crop of 1871, 900,000 baskets were shipped to outside markets. Apple-culture appears to be declining. For several years this fruit has not matured well, and the people of the county have been obliged to supply themselves with winter fruit from the North. The losses of fruit, from insects and blight, are estimated at an average of 25 per cent. The most profitable market varieties of peaches are Troth's Early, Mountain Rose, Early York, Old Mixon, and Crawford's Early. It is found that old varieties, formerly great favorites, have of late years declined in productiveness, and that other varieties have superseded them.

From Sussex County we have a report of the very large fruit farm of Ex-Governor William H. Ross, near Seaford, embracing 275 acres of trees, mostly in bearing. From 1,800 bearing trees an average crop of sixty bushels per acre is secured, realizing from first purchasers about $5,000 per annum. These are chiefly peach trees, twenty feet apart, which fail about every alternate year from frosts. The apple trees yield a full crop once in two years, bearing about a third of a crop in alternate years. The pear crop is pretty sure, failing about once in ten years. A small vineyard of two and a half acres and 2,600 vines produces about two and a half tons of grapes per acre, worth at the vine-

yard about 9 cents a pound. These vines are seven years old and consist of thirty varieties, mostly Concords and Ives's Seedlings. The loss of fruit averages about 33 per cent. per annum.

MARYLAND.—The largest fruit enterprise reported from Maryland is that of C. P. Morton & Co., on Chester River, in Queen Anne County, Eastern Shore. This tract of 1,200 acres was purchased 12 years ago at $14 per acre. The senior partner, who lately retired from the firm, disposed of his interest on the basis of $80 per acre. There are 100,000 bearing peach trees in the orchard, the crop of which nets annually between $20,000 and $30,000. A large proportion of the fruit is canned, but heavy shipments of fresh peaches are made daily during the fruit season to Baltimore and Philadelphia.

The profits of peach culture in this county are variable. Mr. William H. Jacobs, of Centreville, states that his peach trees in 1870, then in their second year's bearing, averaged three pecks per tree, and yielded a net profit of $140 per acre. Last season the average crop was a bushel per tree, but the net profit was cut down to $22 per acre by the immense general crop and by the unusually early ripening and rapid decay of the fruit. The season for medium and late peaches was reduced from six weeks to four, the fruit ripening in too quick succession. The fluctuation, however, has not greatly discouraged the peach culture. The small stock of canned fruit on hand and the late rise in prices indicate an expanding market. There are about 300,000 bearing trees in the county and 200,000 trees not yet in bearing. They are generally planted twenty feet apart. Of market varieties the earliest is Hale's Early, which is somewhat uncertain from its tendency to rot. Troth's Early, large Early York, Crawford's Early and Late; and such others as afford a regular succession are generally planted. In pear culture the tendency now is to rely upon a few good varieties, such as the Bartlett, Seckel, Duchesse, &c. The strawberry-growers, tired of the market fluctuations, induced a regular fruit-canner to establish himself in the neighborhood. He now pays 6 cents per quart for the fruit through the season, enabling the growers to realize from $150 to $200 per acre clear profit. The area planted in strawberries has consequently increased. Wilson's Albany constitutes two-thirds of the present crop.

Dr. E. A. Vannost, of Hanesville, Kent County, on the Eastern Shore, states that about one-fifth of that county is devoted to peach trees, planted at the rate of about 120 trees per acre, and averaging a box and a half of fruit to the tree. The net price per box realized by the grower is 40 cents, giving a profit of about $37 per acre. Hale's Early will not pay, as it generally rots badly and does not mature well at any time. Peach culture was not very profitable in this county in 1871.

Mr. Samuel Vannost, of the same locality, has 2,500 trees in bearing, on 20 acres, planted in the spring of 1859. He marketed last year 3,000 bushels, at 50 cents per bushel, clear of all expenses. A neighbor gathered 600 bushels from a single acre. Injuries to fruit were very slight. The best market varieties are Startt's, Crawford's Early, Troth's Early, Stump the World, Melocoton, &c.

Mr. E. P. Janvier, of Still Pond, Kent County, has 120 acres of peach trees, planted twenty feet apart, all in bearing. He finds that good trees, five to twelve years old, average about 100 bushels per acre, and he states the average net price to the grower to be 30 to 40 cents per bushel. The injuries from insects, &c., are small, with reasonable care. Hale's Early, though a poor peach, by ripening early, brings $1.50 per bushel, while the Early Crawford and Old Mixon sell for but half that

price. Of marketable varieties, he recommends that 5 per cent. of the orchard be planted in each of the following varieties: Hale's, Troth's Early, Crawford's Early, Early York, Reeves' Favorite, Harker's Seedling, Stump the World, and Free Heath, and almost 10 per cent. each in Old Mixon Free, Crawford's Late, Ward's Late Free, Red Smock, and Heath Cling.

Messrs. H. Williams & Brother, Huntington, Calvert County, have 1,250 peach-trees, planted in 1866, producing in their second year of bearing (1871) 100 bushels per acre. The two crops averaged $900 each. The loss from insects, disease, &c., has been about 1 per cent. The best market varieties are about the same as those above enumerated. For three years the orchard was cultivated in tobacco. Every tree is annually wormed and pruned with great care. In 1870, 1,000 boxes of fruit were delivered at the water's edge, at $1.60 per box, giving a net return of $1,400 on 12 acres. The large crop of 1871 caused a large amount of fruit to be left on the trees. The net return of that year was $400 upon 800 boxes. The fruit is of the best quality, and commands better prices than the Eastern Shore peaches.

Mr. Henry Stabler, of Sandy Spring, Montgomery County, finds the Old Mixon Free, Crawford's Late, and Smock Free the best market peaches, averaging about 2 bushels per tree. Of apples he prefers the White Spice, Cornell's Favorite, Summer Queen, &c. Of pears the Bartlett and Duchesse d'Angoulême are the most desirable. Of grapes the Concord is the only variety that will pay expenses. Grapes usually bring but 4 cents per pound at the vineyard. The borer is the only insect that does any damage to peach trees, destroying an orchard about every ten years unless extraordinary care is taken. Pears are seldom injured by insects, while frequently three-fourths of the apple crop is lost from their ravages.

Mr. W. J. Scofield, of the same locality, loses from insects almost one-sixth of his pear crop each year, while his apples are but slightly affected. His peach trees live but seven or eight years. His best market pears are the Bartlett, Lawrence, Beurré d'Anjou, Duchesse d'Angoulême and Seckel.

Apple culture is the most flourishing branch of fruit-growing in Baltimore County. Mr. C. Gingrich, of Reisterstown, has 400 trees upon ten acres. The best varieties are winter apples, such as the Baldwin, Bellefleur, Fallawater, &c. Summer apples do not pay expenses. Good winter varieties bring $1.50 to $1.75 per bushel. He averages 90 to 100 bushels per acre. The apple-borer is troublesome. The trees should be kept free from grass, well scraped, and washed with strong soap-suds, in which sulphur has been mixed.

In grape culture Mr. G. H. Mittnacht, Pikesville, Baltimore County, reports 11,000 vines planted on 16 acres, the results of which, so far, have been very encouraging. The yield of 1871 was "enormous," the bunches being very large. Some Concord bunches weighed one pound four ounces, and averaged over one pound each. He sold about 2,500 pounds of fruit at 10 cents per pound, and made 1,500 gallons of Clinton and Concord wine. He closely watched the insects and carefully protected the birds. No indications of rot were seen, and but slight symptoms of mildew, after a rain-fall of five inches in August. These symptoms were removed by cutting away the superfluous, unhealthy leaves, and admitting air and light. A neighbor, about a mile distant, lost all his grapes from mildew. Mr. Mittnacht trains his vines after Fuller's arbor system. He finds the Concord the best market grape.

VIRGINIA.—Mr. G. F. B. Leighton has an extensive pear-orchard near

Norfolk, Virginia, in which, it is claimed, have been raised the largest and finest pears on the continent. The orchard available for marketing embraces about 5,200 trees; another orchard, designed more particularly for experimental purposes, includes about 1,000 trees. Of the former, 1,200 were planted in the winter of 1866–'67; 2,000 in the winter of 1867–'68; 2,000 in the winter of 1868–'69, in a clay soil, underlaid, at the depth of five to ten feet, with sharp sand, sinking into quicksand. Dwarf trees are planted twelve and one-half feet apart each way, in holes three and one-half feet square and three feet deep. To secure perfect drainage a post-auger hole is bored down to the sand and filled with oyster-shells, about a bushel of the shells being left in the bottom of the large hole. Then about six inches of finely-cut brush (hard-wood) are added, and the hole filled up with top-soil, mixed with a compost of muck, woods-earth, and lime. The fresh muck is seasoned with a small quantity of salt. In planting, the bunch at the joining of the quince and pear stocks is placed two inches below the ground. No crops are allowed in the orchard, except occasionally the black pea, to be turned under as a fertilizer. The pear-tree, which requires a rich soil, is often injured by the presence of other crops. Strawberries are placed by Mr. Leighton at the head of the list of "pear-food robbers." He finds that the energies of the soil must be given exclusively to this fruit, or the culture will not be profitable. He avoids barnyard manure, but supplies bone and ashes when the trees come into bearing for fruit food. He finds the following requisites for successful culture in Eastern Virginia:

1. Perfect drainage.
2. Stiffest clay soil.
3. Proper planting of the trees.
4. Clean culture.
5. Healthy trees, which can be had of responsible nurserymen direct, without the intervention of an agent, and imparting the satisfaction of having every tree true to name.
6. Timely supply of proper food, for growth of both wood and fruit.
7. Determination, patience, and sufficient of the sacrificing spirit to remove all fruit until the tree has sufficient wood to sustain it, without checking the wood growth.
8. Judicious pruning, (better none than too much.)
9. Careful picking, packing, and handling of the packages.
10. The right kind of an agent to dispose of them.

At the recent exhibition of the American Pomological Society at Richmond, Mr. Leighton exhibited three Duchesse d'Angoulêmes, grown on the same tree, of which two weighed thirty and a half ounces each and the other twenty-four and a half. His trees of this variety averaged about a bushel each. When California pears were selling at $9, he received $12 per box for these pears, and $11 for Bartletts. His orchard is composed mainly of these varieties. In quality of fruit he, last year, surpassed the famous pears of California.

A prominent fruit-growing enterprise in Virginia is that of Mr. Chalkley Gillingham, Accotink, Fairfax County, embracing 100 acres of peaches, 100 acres of apples, and 10 acres of pears. The planting of these trees dates from 1849, continued by annual additions, up to the present time. Of apples, summer and autumn varieties form each one-fourth of the planting, and winter varieties one-half. The best early-market apples are the Edwards's Early, Early Hagloe, Astrachan, Early Ripe, &c.; of fall apples, the Fall Pippin, Gravenstein, Maiden's Blush; of winter apples, the Abram, Albemarle, Bowling's Sweet, Ridge Pippin, &c. From 500

peach trees in bearing, 300 bushels of fruit were sold last season, at an average price of $1 per bushel. The pear trees are mostly young. Those in bearing last year fruited finely, the fruit bringing $4 per bushel. Insects have injured apples and peaches, both fruit and tree. Some unknown insect has stung and killed the ends of some apple limbs, especially of the Early Hagloe, leaving other varieties alongside entirely untouched.

Mr. Robert Harrison, Garysville, Prince George County, states that the best market apples for that region are the Horse Apple, Gloria Mundi, and early varieties. One tree of Gloria Mundi produced apples which sold for $10 last season. Grapes brought 10 cents per pound. The Concord is the best variety. Very little injury from insects was noted.

Mr. J. S. Green, Amissville, Rappahannock County, finds Baldwins the best market variety of apples. He has suffered but little loss from insects, except bees and wasps. His vineyard, principally Catawba, yields 200 to 300 gallons of wine per acre.

Mr. James Newman, Gordonsville, Orange County, has 200 bearing apple-trees, averaging 12 bushels each, or 300 bushels per acre, worth 25 to 30 cents per bushel at the orchard. The loss of trees is about 2 per cent. per annum, from unknown causes. The loss of fruit is rare. The Albemarle Pippin is the best market variety, almost the only one that will pay expenses.

Mr. William Hotopp, Charlottesville, has fourteen acres in grapes, mostly Delaware, Norton, Ives, and Concord. The Delaware brought 15 cents per pound in New York, Ives 11 cents, and Concord 8 cents. The Iona, Rebecca, and Israella are not considered worth planting.

Mr. D. S. Bell, Fisherville, Augusta County, has found the Fallawater apple the only one maturing well. His Rambo trees blighted near the root in 1865, but are recovering. No other injuries noted. His Concord grapes yield very largely. No mildew or rot reported, but almost the whole crop of 1871 was destroyed by the bees.

Mr. Alex. Asher, Gloucester, lost about 5 per cent. of all varieties of fruit. Half of his losses in apples were from the ravages of rabbits. The most profitable market peach is Hale's Early; the market apple most popular, the Early Harvest.

Dr. G. W. Briggs, Suffolk, Nansemond County, reports the sale at $2,000 of a single crop of ten acres of Yellow June and Early Harvest apples. He states that $150 has been realized from a half-acre crop of Horse Apples, and that single trees have netted $15 to $30. Single pear trees—Bartletts, Seckels, and Moore's White Pound—have frequently paid $20 to $40. On well drained soils, carefully cultivated, the ravages of insects are inconsiderable. A variety of the borer attacks the limbs of the Early Harvest apple. A fly, probably *Saperda candida*, whose grub, a white worm with blackish head and strong mandibles, burrows in the alburnum, and ravages the Horse Apple, invariably commencing near the notch of the first tier of limbs. A thick wash of salt and lime applied every spring has been found a preventive. A fruit-grower on Nansemond River, whose sales of early fruit amount to $6,000 per annum, says that no apple pays well that is not ready for market in advance of the Maryland and Jersey fruits, ripening about the second week in August. The popular northern varieties, when transferred to this region, mature too rapidly to be good keepers.

Mr. H. M. Armistead, Campbell Court-House, with three acres of vineyard and 3,000 vines, has made 800 gallons of wine per acre, which sells for $2.50 to $5 per gallon. The vines are Ives, Concord, Iona,

Alvey, Delaware, Rogers's Nos. 4 and 15, Hartford, Clinton, Catawba, &c., six to eight years in bearing. These grapes are comparatively free from rot and mildew, and are all superior for wine or table use.

Mr. John C. Murrell, Campbell Court-House, raises 300 bushels of apples per acre, worth 50 cents per bushel. His best market varieties are Wine Sap, Russet, and Lady apple.

Mr. John F. Martin, of James City County, has 3,750 apple-trees, which averaged last season five bushels each, worth $2.50 per barrel. His best varieties for market are Striped June and Catshead.

Mr. R. C. Davis, Nelly's Ford, Nelson County, has 3,000 bearing apple-trees on 89 acres. The yield per annum ranges from one to fifteen bushels per tree; losses about 20 per cent. He prefers, as market varieties, the Pippin, Esopus Spitzenberg, Baldwin, &c.

Messrs. Miller and Wood, Little Washington, Rappahannock County, have 100 acres in apples, thirty-two feet apart, with peach-trees intervening. The apple-trees yielded last year 150 bushels per acre, worth $1.25 per barrel. The crop was shortened about one-third by drought. Their best market variety is the Pippin. Their Concord grapes yielded 5,000 pounds per acre; Catawba, 2,500; Delaware, 1,000; Clinton, 2,000; average price per pound, 5 cents. The best market grape is the Catawba.

NORTH CAROLINA.—From North Carolina our reports are full and specific, indicating that the fruit industry of that region has attracted in unusual proportion the intelligent and practical minds of the community. Some of the facts reported indicate astonishing results. These statements are given as reported. The name and address of each correspondent being given, parties desiring further information may communicate with them personally or by letter. The Ridgway Land Owners' Company, Ridgway, Warren County, J. L. Labiaux, manager, reports 1,000 acres in peaches, planted in the spring of the years 1868 and 1869. The trees are set twenty feet apart, and number 109,000, of which 50,000 bore a small crop in 1871. They are all early varieties, selected with reference to the opening of the northern markets. Last season 2,200 bushels, shipped to New York, brought $7 per bushel. The manager calculates upon an average of two bushels to each tree, when in full bearing. The same association, in the spring of 1869, planted on thirty acres 9,000 Concord, Catawba, Isabella, Clinton and Ives's seedling grape vines.

The Excelsior Planting Company, Rocky Point, New Hanover County, has 100 acres in peaches, planted in 1869, and 25 acres in apples and 10 acres in pears, planted in 1870. The whole number of peach trees is 10,000. From the few trees in bearing, about 800 bushels of fruit were marketed last year, at $1.50 per bushel. Hale's Early rotted badly in transportation to market. If rapid transportation can be secured, this variety will be the most profitable for market. The loss from insects was inconsiderable. The apple trees were planted twenty feet apart, in rows thirty feet distant; the pears are arranged at eight and ten feet apart. Neither the pears nor the apples have yet begun to bear. The company has also a vineyard of 70 acres and 13,150 vines, of which 10,000 are Concord, 2,000 Mish, 1,000 Madeira, 100 Scuppernong, and 50 Flower. For northern markets the best varieties are the Concord and Hartford Prolific. But few of these vines are yet in bearing. The Concord grapes sold last season at 15 cents per pound.

Mr. R. Rogers, Webster, Jackson County, says that in that region many apple trees twenty years old will average 25 bushels each per an-

num. Some yield 80 to 100 bushels each. The distance of the markets, however, renders only late-keepers available.

Messrs. C. W. Garrett & Co., Ringwood, Halifax County, have 125 acres in vineyard, upon which are planted 8,000 Scuppernong, 5,000 Concord, 500 Delaware, 500 Iona, &c. The Scuppernong yields about 100 bushels per acre, which are made into wine. From 400 of these vines, covering 5 acres, are annually made 3,000 to 5,000 gallons of wine, worth $1 per gallon as still wine. By converting it into sparkling wine it brings $10 per dozen. The Scuppernong is not troubled with rot or mildew.

Mr. J. B. Zollicoffer, Weldon, Halifax County, has 8,000 to 10,000 apple-trees and about 7,000 peach trees in bearing. He has been unable to secure his pear trees against blight.

Messrs. J. Lindley & Son send a printed catalogue of their large nurseries near Greensborough, Guilford County. This enterprise has been forty years in operation and has collected all the varieties of fruit suited to that locality.

Dr. J. G. Peterson, Morganton, Burke County, who is engaged in the nursery business, states that an apple tree in his neighborhood yielded last season 125 bushels of fruit. There are many localities in that region in which (it is claimed) there has been no failure of the peach crop for thirty years. Thousands of acres of land in this part of the State, admirably adapted to fruit culture, are for sale at very low prices.

Among the remarkable cases of grape production may be mentioned that of Mr. Daniel Asbury, Charlotte, Mecklenburgh County, who gathered from a single five-year old Perkins vine 129 pounds of ripe grapes. He has 7 acres in vineyard, planted in Catawba, Hartford, Concord, Perkins, Delaware, &c. He proposes to set out 24,000 vines during the spring of 1872. Dr. J. J. Thornton, of Milton, Caswell County, raises 250 bushels of apples per acre, worth from 50 cents to $2. Pears would do very well but for the curculio. His best market apples are the Wine Sap, Romanite, Vandevere, &c. A correspondent in Alleghany says that in some cases 1,000 bushels of apples are raised to the acre, but, the market price being not over 15 cents per bushel, the fruit is left to the hogs. Mr. M. S. Davis, of Louisburgh, Franklin County, has an orchard on the brow of a hill with a northern exposure, which has failed but three times in twelve years. A neighbor's orchard, one hundred and fifty yards distant, with a southern exposure, has borne but three or four good crops during that time.

Mr. J. A. Caldwell, Lincolnton, Lincoln County, has 25 acres in apples, planted from 1850 to 1863. He has 400 apple-trees, fifty feet apart, raising 500 to 600 barrels per annum, worth about $1,000. Three-fourths of the last crop were destroyed by insects, casualties, and disease. The best market varieties are the Magnum Bonum, Tender skin, and Fleming.

The Lincoln Wine Company, of Lincolnton, Lincoln County, has 400 Lincoln vines on three-quarters of an acre, which produced last year 4,500 pounds of grapes. These were made into wine, yielding a gallon of juice to each 15 pounds of fruit. At the age of one year this wine sells in New York at $3.50 to $4 per gallon; four months old it will bring $1 to $1.50. No loss from mildew or insects during the last two years.

Mr. L. Frœlich, of Enfield, Halifax County, a vineyardist of forty years' experience, twenty years of which were spent among the vineyards of the Rhine, has two large vineyards; one of these, of fourteen acres, in Duplin County, was commenced twelve years ago. Three-

fourths of the vines are Scuppernong and one-fourth of the leading varieties of bunch grapes, such as Catawba, Concord, Diana, Isabella, Clinton, Hartford, Norton, Iona, &c. After the first two years he found that he had planted his vines too closely, the bunch grapes six feet apart, in rows eight feet apart, and the Scuppernong fifteen feet by fifteen. He also pruned his bunch grapes too severely, in consequence of which the grapes were rather knotty. He then cut out every alternate row of bunch grapes and each alternate vine in the remaining rows. The wisdom of this change was soon demonstrated in the growth of heavy crops of fine fruit. Subsequent plantings, fifteen and eighteen feet apart, produced still more abundantly. He enlarged the spaces between his Scuppernong vines, first to thirty feet, then to forty-five feet, and finally to seventy feet, and each enlargement was followed by a corresponding increase in quantity and improvement in quality of the crop. The early bunch grapes bring good prices in the northern markets. The Scuppernongs are fit only for wine-making, ripening too late for market grapes, and requiring to be gathered within twenty-four hours of ripening.

The bunch grapes are generally prolific up to their sixth or eighth year, when they show tendencies to disease. The Catawba and Isabella begin to rot, and the Diana grapes to spot and fall off before ripening. For some time he found a partial remedy for this decline in heavy sulphuring, but subsequently he discovered, by mere accident, the cause of the difficulty, and was enabled to apply a perfect preventive. On transplanting some vines and trimming their roots preparatory to replanting, he found that the main heart root had been undermined by a worm or borer like that which infests the peach tree, probably *Ægeria* (*Trochilium*) *polistiformis*, or a larva of a *Prionus*. From one drooping vine he dug out five or six borers. By completely relieving his vines of these pests, he found that they became very flourishing and productive. To accomplish this end he took up the soil from the main roots and dug down as far as he thought the insects had found harbor. He then cleaned the roots nicely and spread over them oak and grape-leaf ashes, leaving the holes open till after a fall of rain, when the ashes were again applied. By this time about a peck of ashes had accumulated over each root; he then covered them with rich top-soil. The following year the vines bore tolerably well, and the second year's crop was enormous and free from disease.

Mr. Frœlich is an enthusiast in the culture of the Scuppernong, of which variety he has 8 acres in full bearing in Duplin County, and 150 acres, from one to three years old, in Halifax County. He has also, within the last two years, set out 5,000 acres of Scuppernong vines for other parties. This vine grows in any kind of soil, from the highest and dryest sand-hill to the lowest swamp land, fruiting abundantly in all these soils and never indicating disease. The best soil, however, is sand underlaid by clay and naturally drained. The vine roots are planted two and two, in holes four feet square and two feet deep, filled three-fourths full with top-soil, and one-fourth of compost, as rich as possible. He prefers to plant in December, covering the roots four inches deep; later plantings, six inches deep. After the vines have commenced growing the first season, all the side sprouts are pinched off, only the main shoot being allowed to grow. This is done in summer, and while the wood is green. The Scuppernong will not bear winter-pruning. A limb a quarter inch thick, pruned from a half-grown vine, will cause it to discharge a gallon of sap in a day, which will fatally impoverish its strength.

During the second year the vines will have grown so rapidly as to require support. A temporary arbor of four poles at the corners of a square, ten feet apart and furnished with the requisite cross-pieces, will suffice to the end of the third year. The vines are carefully spread out upon this frame-work, and the fresh side shoots should be pinched off as they appear. In the fourth year a wire arbor is made over the whole vineyard, fastened upon posts nine feet high and twenty feet apart. It is important that the vine be spread equally in all directions, to give full access to air and sunlight, uniformly ripening all the fruit. Grapes imperfectly ripened make the wine too sour. This is the work of December. In the third year the process of manuring commences, which is repeated every two years. The roots of the vine spread out as far as the vines on the arbor. A trench is then dug around the outside roots, two spades wide and one spade deep, and filled with compost. With these precautions the vines will meet each other in nine or ten years. Each vine, in the third year, will bear about a peck of grapes; in the fourth year, two bushels; in the fifth year, five bushels. He claims that when in full bearing they will average 400 to 500 bushels per acre, from which 2,500 gallons of juice may be expressed.

Mr. Frœlich says that the Scuppernong is the only vine in the world that will produce this quantity of grapes, or wine, and the only vine that has been known for two hundred years without disease. Vines in his neighborhood have reached the venerable age of one hundred and fifty years, and cover one and a half to two acres. A vine of this age in Nash County, covering two acres of ground, yielded, last season, forty-eight barrels of wine, although its supports were dilapidated, and not a cent had been expended in cultivation.

Of the Scuppernong family Mr. Frœlich cultivates ten different varieties, the most of which, last season, presented the following exhibit of saccharine strength, according to Oeschle's scale: 1. Frœlich's White Seedling, 95°; 2. Common White Scuppernong, 80°; 3. Mish, 90°; 4. Flower, 88°; 5. Black Scuppernong, 82°; 6. Pamlico, 80°; 7. Thomas, 90°; 8. Beaufort; 9. Tender Pulp, 80°; 10. Sugar Grape, 80°. The White Seedling and White Scuppernong make a delicate straw-colored wine; the Beaufort, a purple wine; all others, red wine. These grapes all ripen during October. The White Seedling and White Scuppernong become of a dark-red copper color, shrinking somewhat when dead ripe. The Beaufort is about the size and color of the Diana. All others become very dark or entirely black. He is very careful in gathering his grapes. He spreads upon a frame 12 feet square a strong cloth with an orifice in the center, about a foot in diameter, under which is placed a barrel or box. The grapes are gently shaken into the cloth, sinking down through the orifice. Six hands will in this way gather 1,000 bushels per day. The grapes are then mashed in a grape-mill, constructed in such a manner as not to crush the seed or bruise the skins, thus avoiding the bitter oil of the former and the peculiar acid of the latter. They are then put in an open cask, with a false bottom, through which have been bored about three dozen half-inch holes. In six hours, juice amounting to two gallons per bushel is obtained. This juice will make an excellent wine without any qualifying substances. The mashed grapes are then pressed in a mill, and will yield two gallons of wine more per bushel. This is made into a fine drinking-wine by gallizing. Mr. Frœlich proposes hereafter to manufacture what comes from the press into brandy and vinegar. If the juice, either dripped or pressed, shows 80° of sugar, it will make a normal, good wine. From 6° to 9° of acid indicate a pleasant wine. If the acid is too great the wine must be

thinned with water down to the standard. If Oeschle's scale shows less than 80°, sugar must be added to bring the juice up to that figure. Grapes purchased from less careful cultivators yielded only 60° to 65° of sugar and 10° to 12° of acid, while his own grapes yielded 85° to 95° of sugar and only 4° to 7° of acid. After the must is regulated, it is put into clean casks, leaving a clear space of a finger's length from the bung-hole. A curved fermenting tube is then fastened air-tight in the bung-hole, and its outer end immersed in water, permitting the fermenting gas to escape and preventing the entrance of the external air. This prevents the conversion of a large proportion of the grape-sugar into acid, instead of alcohol, and the loss of bloom and flavor, all of which are the result of common bung-hole fermentation. The wine also ferments more equally and perfectly in large casks, with stout staves and heads, than in small thin barrels. The loss of wine oozing through the latter is estimated at 5 per cent. per annum. The fermenting period lasts three weeks; the tube is then taken away and the cask filled and closed air-tight. About Christmas the clear wine should be racked into another cask, which should be filled full and closed air tight. The loss from leakage should be continually replaced, leaving no vacant space in the cask in which acid may be generated. The wine should be racked again about the 1st of April and on the 1st of October. It should be racked annually, afterward, about the last-named date. It is ready for market about two weeks after the second racking, but will be still better after the third. The sediment from the first racking should be collected and permitted to settle again. About half of it will be good wine; the remainder may be distilled into brandy or made into vinegar.

Mr. Frœlich estimates the expense of preparing an acre of vineyard as follows: Average price of land per acre, $10; twenty-five well rooted vines properly set in the ground, $8; fifty loads of compost, $10; arboring with posts and wire, $50.90; total, $78.90. The annual expense of cultivation is given at $14.25; of gathering grapes and pressing the juice, $3; incidental expenses, $2; interest on capital invested, $5; casks for 2,000 gallons of wine, $75; total, $99.25. *Per contra*, 2,000 gallons of wine, at 90 cents per gallon, will bring $1,800, leaving a net profit of $1,700 per acre. Mr. Frœlich states that he has made very liberal allowance for all expenses in the above estimates. He is satisfied that with the improvement he has made, both in the culture and manufacture, within the last twelve years, he has enlarged the margin of profit. These statements are given on the authority and from the experience of this intelligent cultivator, but we cannot warrant equally successful results to any amateur Scuppernong vine-grower. New York is the best market for his wine. It is mostly sold by the 1,000 gallons, as champagne. He generally sells after the second racking. For wine two to four years old he receives $1.50 to $3 per gallon. His grape brandy, one year old, brings $5 per gallon. From the juice of one acre of grapes he claims that 300 gallons of brandy, or 3,000 gallons of vinegar, may be made, the latter worth 50 cents per gallon.

Mr. Frœlich insists upon great care in the selection of well rooted plants, raised from thrifty, ripe wood. The best are one-year-old limbs not over a fourth of an inch thick. They can be raised only by layers, and will not grow from cuttings. They should be laid about February, and will be well rooted for planting in the following autumn. Mr. Frœlich is satisfied that Scuppernong wine may be profitably raised at 30 to 40 cents per gallon, and that it can be made of a quality that will supersede the immense importations of wines.

SOUTH CAROLINA.—No reports have been received from South Carolina of fruit enterprises for general market. The local demand is generally supplied by a primitive home culture, while facilities for transportation are confined to a few localities. The capacity of this State for all kinds of fruit production is abundantly shown, however. As a specimen of the actual culture, the report of Mr. R. F. Simpson, Pendleton, Anderson County, may be selected from about a dozen returns. This gentleman has 30 to 40 acres in apples, pears, peaches, and plums. His apple trees—Red June and a few summer and winter varieties—are planted at the rate of 91 trees per acre, and produce, when in full bearing, 6 to 20 bushels each per annum. Peach trees, 140 per acre, average about 5 bushels each. Pear trees, 100 per acre, average about the same. Apple and pear trees are subject to blight. Peach trees last about 20 years. From different parts of the State come reports of the productive capacity of the Scuppernong grape, similar to the statements from North Carolina.

GEORGIA.—Mr. P. J. Berckmans, Augusta, Richmond County, has 50 acres of apple, peach, and pear trees, planted at various dates from 1851 to 1871. His apple-trees, 2,500 in number, twenty feet apart, are of the Red Astrachan, Carolina Red June, Red Margaret, Early Harvest, &c. The earlier varieties brought $3 per bushel last summer; mid-season, $1 to $1.25; late, $2. His 4,000 peach trees are set fifteen feet apart, and consist of Hale's Early, Early Tillotson, Crawford's Early, Amelia, &c. Hale's Early, the first ripening, brought $3 per bushel; varieties ripening after July 5, about $1.50; later kinds, but 50 cents. He has 5,500 pear trees, ten and twelve feet apart. Pears brought $4.50 and $5 per bushel. His principal varieties are Duchesse d'Angoulême, Bartlett, Seckel, and Beurré d'Anjou. He observed no losses from insects last year. A small portion of mid-season peaches rotted. His best plums are the Wild Goose and some varieties of the Chickasaw type. Mr. Berckmans has, also, a vineyard of 10 acres, with 3,500 vines, 3 to 15 years old, consisting of Scuppernong, Delaware, Israella, Concord, Ives, &c. The Ives brought 30 cents per pound; Early Delaware, 30 cents at first, later, 20 cents. About three-fourths of the Concord rotted. Warren and Iona were a total failure. No other losses observed. For market, Ives, Concord, Delaware, and Diana are preferred varieties; for wine, Ives, Delaware, Clinton, Devereux, and Scuppernong are recommended. Most of the orchards and vineyards of this region have fallen into decay, from lack of cultivation. This result is attributed to want of early shipping facilities, from the difficulty of getting correct returns from New York commission-merchants, and from the vast amount of local depredations upon orchards.

Mr. O. B. Thompson, Gainesville, Hall County, has 80 acres in apples, pears, peaches, figs, and miscellaneous fruits, planted at different times since 1863. He finds the Shockley apple the best market variety, having planted 3,250 trees of that kind, and only 50 of any other. His trees, 70 per acre, at the age of fifteen years, average about 10 bushels of fruit each, some yielding as high as 35 bushels. A tree on a neighboring farm bore, at one crop, 120 bushels. Mr. Thompson's losses, from insects, amount to about 1 per cent. per annum.

Mr. John C. Carmichael, Greensborough, Greene County, has 34 acres in apple-trees, mostly Shockley, Nickajack, Magnum, and Equineteley. He lost the entire crop last year from rot. The trees have never been manured.

Mr. Richard D. Winn, Lawrenceville, Gwinnett County, deems the Shockley the best market fruit. His apple-trees, planted twenty-five

feet apart, yield about 1,000 bushels per acre. Early varieties bring $1 per bushel. The most serious casualties are from late frosts.

Mr. J. S. Newman, editor of the Southern Times and Planter, Sparta, Hancock County, has 33 acres with 3,225 trees, nearly all in bearing. His apples bring $1.50 to $3 per bushel; Bartlett and Duchesse pears, $5 per bushel. Fruit ripens here fully a month earlier than in New York, but the lack of facilities for shipment renders this advantage unavailable. The borer destroys about 1 per cent. of the apples and peaches each year. Pears lose about 2 per cent. from blight. His best market apples are Red Astrachan, Taunton, and Shockley; best pears, Bartlett and Duchesse; best peach, Early Tillotson; best strawberry, Wilson's Albany.

Mr. James Postell, Brunswick, Glynn County, has 250 olive-trees, thirty feet apart, planted in 1825, all in bearing. The trees average 5 gallons of oil each season, with but little attention and with rude processes of manufacture. With proper cultivation and machinery the product might be made of a quality unsurpassed in the world. Last year the oil produced amounted to 1,250 gallons, worth $8 per gallon. No injuries from insects or diseases reported.

Mr. R. J. Moses, Columbus, Muscogee County, reports 120 acres in apples, pears, and peaches, commenced in 1850, but replanted in 1866. He has 8,000 peach-trees, eighteen feet apart; 1,000 apple-trees, eighteen and twenty feet apart; and 300 pear-trees, twelve feet apart, all in bearing. Since he has kept no hogs the curculio has seriously injured his trees, in many cases totally destroying them. His best market peaches are Old Mixon Free, Malocoton, and Chinese Cling. He has 18 acres in vineyard, with 30,000 bearing vines, Catawba and a few of the Scuppernong. In good seasons his vines yield about 100 bushels per acre.

Mr. George C. Munroe, Buena Vista, Marion County, about fifteen years ago, 75 to 100 acres in seedling peaches, planted mostly for feed for hogs. The trees are ten feet apart in rows twenty feet distant. The average yield is 50 bushels, worth 20 cents per bushel for feeding swine, and 40 cents for brandy. Mr. Munroe finds it cheaper to let the trees die out and replace them than to bestow special attention for their preservation.

Mr. J. M. Harlan, Calhoun, Gordon County, raises 40 bushels of apples per acre, worth $1.25 per bushel. He finds the Shockley apple 50 per cent. more profitable than any other variety.

FLORIDA.—Our reports from Florida indicate that very little has been done in that State in the way of fruit-growing for market. A few profitable enterprises in tropical and sub-tropical fruits are reported. Oranges, lemons, bananas, figs, guavas, &c., have been cultivated to some extent. Of northern fruits, apples, pears, peaches, and plums have been successfully grown in some quarters, but in their culture, as market fruits, no decisive experiments have yet been reported.

Mr. T. R. Collins, of Wicksville, Columbia County, plants peach trees at the rate of one hundred to the acre, and averages two bushels to each tree. His entire crop from two acres would not have brought $20 in the local market. Fruit crops are subjected to losses from frost, heavy rains, birds, &c., averaging 33 per cent. per annum, the past ten years.

Mr. J. Gates, Manatee, Manatee County, has 10 acres in orange-trees of various ages. The trees number 10,000, and average 600 oranges each per annum, selling at 1½ to 2 cents each. The losses from casualties of all sorts average 20 per cent. per annum.

Dr. Z. M. Mason, Apopka, Orange County, reports an increasing orange culture in that county, in which there are about 5,000 bearing

trees, and 100,000 not yet in bearing. Trees sixteen years old average 2,000 oranges in fruitful years. During the past season, however, a heavy cyclone denuded the trees of fruit, reducing the crop to one-third of the previous one. The ordinary price at the orchard is $3 per hundred. The banana is attracting attention, there being 60,000 plants growing in the county. The severe cold of December destroyed many of the younger plants. The horse or hog banana is considered the most profitable. One grove in the neighborhood yields an average monthly return of $125.

Mr. W. Mills, of the same place, states that a farmer in the county, in 1866, planted 9 banana plants, and that, having sold, besides the fruit, three-fourths of his increase in plants, he now owns from 10,000 to 12,000. He averaged $400 per acre, with one-tenth of the labor necessary to raise corn.

In a few cases efforts at grape culture are reported, but they are mostly confined to the great favorite in the South, the Scuppernong.

Mr. J. T. Humphries, Clear Water, Hillsborough County, has 2 acres in sweet oranges, Sicily and Florida lemons, bananas, guavas, and peaches. He has 100 sweet-orange trees, planted at various times from 1859 to 1870, which yield at the rate of 60,000 oranges per acre, worth about $600. His lemon-trees, one Sicily to eight Florida, yield at the rate of 100,000 per acre, worth about $1,000. The bananas yield 600 heads per acre, worth about $1 per head. Guavas yield about 1,000 bushels per acre, and are worth 15 cents per bushel, mostly as pig-feed. As the trees require neither pruning nor cultivation, this crop is about the cheapest swine-feed that can be raised. No losses have been experienced from diseases, insects, or casualties, except the injuries to bananas and guavas from the December frosts of 1868 and 1870. Both these crops are now flourishing. The orange blossoms were blown off by a heavy storm last August, yet, from a tree four years old 800 oranges were gathered. Oranges, lemons, and bananas are in good demand, paying good returns upon investments. Mr. Humphries does not consider his orange trees a very favorable specimen of the capabilities of the culture.

ALABAMA.—Some fruit enterprises, but few with reference to fruit for market, are reported from Alabama. Mr. S. W. Price, Rehoboth, Wilcox County, has about 80 acres in different kinds of fruits, two-thirds being peaches. He commenced planting ten years ago, and has planted or replanted 100 to 500 trees each year. The apple, pear, apricot, and plum flourish, rarely decaying, but the peach tree has a less permanent existence, owing to the ravages of the borer at its root. His peach trees, 134 to the acre, when in full bearing, average 5 bushels to the tree. The fruit of this orchard is mostly distilled, a bushel of peaches yielding about three gills of brandy. The annual loss of peach trees is about 1 per cent. The best varieties of peaches are the Large Indian, Large Yellow Cling, Early York, Fox's Seedling, and Hale's Early. Mr. Price has a small vineyard which, for lack of skilled labor, fails to realize the best results. Three-fourths of his vines are Scuppernong, which, at ten years old, average 10 to 20 bushels of grapes each. Wine from these grapes is worth $4 per gallon.

Dr. James Clegg, Almond, Randolph County, has 9 acres in different fruits two to ten years of age. He realizes about 400 bushels of peaches per acre of bearing trees. A few trees are injured by the grub-worm. Earlier varieties are the best for market. He has 100 grape-vines, of which 90 are Scuppernong.

Mr. George S. Gulitt, Camden, Wilcox County, has 700 peach trees

and 500 apple trees, planted seventeen feet apart, on 8 acres. He raised last year 1,000 bushels of peaches and 250 bushels of apples, and realized $1,200 to $1,500 for the crop. He lost only about half a dozen peach trees. The borer was detected in the roots of about half his peach trees in 1870. He then exposed the roots from September to April, when he banked the dirt twelve inches high round the foot of each tree. The borer has not since appeared. The curculio injures the peach, especially the Chinese Cling. The only apples profitable for market culture are those that ripen late and keep during the winter. In low, flat places, crops are killed four years out of six. On high grounds they seldom fail.

Mr. P. T. Graves, of Manack, Lowndes County, obtains 400 bushels of peaches per acre; apples, 500 to 600 bushels; pears, 300 bushels. Peaches are injured by borers. Mr. Graves raises several varieties of pomegranates, viz: Acid, Red, Sub-acid, Sweet Yellow, Russet, &c. Mr. William S. Earnest, Elyton, Jefferson County, has 250 Scuppernong vines, 100 of which are in bearing. He would not waste ground on any other sorts. When in full bearing he will gather from 300 to 500 bushels of grapes. He converts his whole crop into wine, realizing $1 per gallon.

Dr. N. B. Cloud, of Montgomery, presents a view of the fruit industry of the region in which he resides, which is not very flattering. Very little interest is taken in the business. Much of the fruit grown is of inferior varieties, without culture or fertilization. Prior to the late civil war, quite a spirit of enterprise was inaugurated. Dr. Cloud has started a small orchard and vineyard near the city, which he proposes to cultivate on scientific principles.

MISSISSIPPI.—Mr. John C. Humphrey, Port Gibson, Claiborne County, has 12 acres in apples, peaches, and small fruits. In fifty years he has known but two failures of the peach crop, both the results of frost. Fruits in that region have few enemies. Even the plum and the apricot are seldom attacked by the curculio. Apple and peach trees are generally set about twenty feet apart. The pear and quince are also successful. Mr. Humphrey cultivates several varieties of native grapes. The Muscadine produces a wine of excellent bouquet, but deficient in sugar. The Scuppernong is nearly its equal.

Mr. W. L. Williams, Rienzi, Alcorn County, reports, among the best market varieties of apples, the Red Astrachan, Red June, Early Harvest, and Shockley; peaches: Hale's Early, Early Tillotson, and Early York; pears: Bartlett, Duchesse d'Angoulême and Seckel; plums: Wild Goose; quinces: Orange and Chinese; cherries: May Duke and Early Richmond.

Mr. T. S. West, Waynesborough, Wayne County, states that during the past season his apple trees were greatly injured by ants. He finds a coating of tar a preventive. An insect called the sawyer, most probably the borer, is the most formidable enemy of the apple-tree. This insect deposits its eggs in the crevices, and the larva subsequently burrows an inch or more into the solid wood.

Mr. A. Taylor, of the same locality, has 12 acres in apples, pears, plums, quinces, and figs. From 200 bearing trees he obtains almost 600 bushels of fruit. Of market varieties the best peaches are Heath's Early and Late; the best apples, Red Astrachan and Striped June. He loses almost half his crops from insects, &c.

In the southern part of the county is a pear orchard of about 1,000 standard and dwarf trees, Madelines, Bartletts, Duchesse d'Angoulêmes mainly, bearing abundantly every other season. The fruit is sent to Chicago, where it brings $12 to $15 per bushel. The fruit is gathered

about a week before ripening. The proprietor is convinced of the suitableness of the long-leafed pine belt for profiable pear culture.

Mr. W. Cunningham, Summit, Pike County, cultivates 78 varieties of apples, 13 market varieties of pears, and 20 varieties of peaches. His pear crop suffers no losses from insects, &c. Apples and peaches, 2 per cent. He finds the best varieties of grape to be Concord, Ives, and Delaware.

Mr. W. H. Cassell has 25 acres in apples, pears, and peaches. Pears and apples average about 100 bushels per acre. The losses, mostly from rot, average 40 per cent. The Bartlett is pre-eminently the best market variety, and then follow in order the Duchesse, the Seckel, the Buffum, and the Jefferson. Some trees are injured by blight.

Mr. H. J. Leavy, of New Orleans, has a fruit-farm of 85 acres near Shieldsborough, Hancock County. He has 4,000 peach trees fifteen feet apart, 2,000 dwarf pear-trees fifteen feet apart, 2,000 orange-trees twenty feet apart. The crop of 1870 was destroyed by frost, and that of 1871 by excessive rains. Losses from insects, about 1 per cent. Early varieties of peaches are the best for market. Of 15 acres of vineyard, 10 are planted in Scuppernong. From 20 vines of the latter variety, 8 barrels of wine were made in 1870. This grape always sells readily.

Mr. W. D. Sprott, Port Gibson, Claiborne County, finds Red Astrachan and Early Harvest the best market apples, and Madeline and Bartlett the best pears.

Mr. W. L. Harper, Fayette, Jefferson County, had most of his peaches, last year, damaged by rot. Hale's Early a total loss. Duchesse pears did well. Birds are the worst enemies of the grape.

Dr. J. A. Leach, Verona, Lee County, produced 1½ bushels of apples per tree; peaches, 5 bushels; pears, 1½ bushels. He sustained but little loss from insects. His winter pears are the best for market.

Mr. R. M. J. Arnett, Reading, Jefferson County, averages 940 bushels of peaches per acre, and of apples, 230 bushels. He loses 25 per cent. from insects. The apple crop seldom fails, except from storms.

Mr. J. J. Colmant, Columbus, Lowndes County, obtains from his orchard an average of $80 per acre for apples, $150 for pears, and $50 for peaches. He loses about 3 per cent. of apples from the borer, 5 per cent. of pears from blight, and 1 per cent. of peaches from various causes. His best market apples are Early Harvest, Carolina June, Astrachan, &c.; best pears, Duchesse, Buerré d'Anjou; best peach, Early Tillotson. The Scuppernong grape never fails; other varieties have done well.

Mr. William N. Raine, Hickory, Newton County, gathers 8 bushels of apples per tree, 5 of pears, 2 of peaches. His annual losses from insects are about 10 per cent. Quinces and figs grow well. Bartlett pears grow very large. Isabella and Catawba grapes rot badly, but the Scuppernong never.

Mr. W. S. Lewis, Louisville, Winston County, raises 500 to 700 bushels of apples per acre, worth 50 cents to $1 per bushel. His greatest losses are from the depredations of rabbits, which gnaw the trees.

LOUISIANA.—Reports from fourteen parishes exhibit great backwardness in fruit culture, even as compared with other Southern States, yet the capabilities of different localities for abundant production are well attested, and the prices realized in many local markets indicate that the business would be a paying one, independent of the general demand. Early peaches and apples are sold for $3 and $4 per bushel, and Bartlett pears at $5. These fruits are not of the best quality. Estimates based

upon the produce of small collections of trees, with little cultivation or care, indicate that crops of 600 to 900 bushels of apples, peaches, and pears may be raised. The early varieties are in all cases the best for market. Trees are planted very close; apples, eighteen to twenty feet apart; peaches, pears, and almonds, fifteen feet; plums and figs, ten to twelve feet. One gentleman reports a loss of 25 per cent. of his last crop from curculio, and 60 per cent. from rot. Another lost his entire crop by storms blowing off, first blossoms, and then the fruit that had escaped. A few grapes are cultivated, the Concord being the best market grape, and the Scuppernong the best wine grape. The fruit interest in this State is as yet entirely undeveloped. A few intelligent gentlemen are disposed to engage in the business, but the market and labor elements of the problem are still unsatisfactory. Agricultural and horticultural societies are few, and as yet imperfectly organized.

TEXAS.—Reports of fruit enterprises in Texas are not numerous, yet they indicate a very hopeful spirit of progress. General Reynolds, San Antonio, Bexar County, has a small orchard of select fruit twelve years old. His greatest success has been in pear culture. From 70 trees the crop last year amounted to 35,000, worth $1 per dozen in gold. His trees are all French varieties, imported from Vilmorin & Co., Paris, embracing Beurré Giffard, Bergamotte d'Été, Beurré de Paris, Bonne Louise d'Araudore, Duchesse d'Angoulême, Bon Chrétien, Saint Germain, and Belle Angevine. His apple and peach trees are also French, such as Reinette Franche, Reinette du Canada, and Api Rosé de Chataigner apples; and Péche Abricotêe, Madeline, and Gros Persique peaches. He also grows figs, quinces, plums, apricots, &c. All these fruits, except the peach and apricot, will be in great local demand for a number of years, inasmuch as no enterprises for their culture are yet in operation.

Mr. C. Rossy, of the same locality, planted 2 acres with 240 peach trees, twelve years ago, and since they began to bear has made a fine crop every year. He finds every variety of soil around San Antonio well adapted to peach culture. Peach-trees are not affected by the borer or by the yellows. Mr. Rossy recommends plowing the orchard twice a year, and top dressing once a year. Seedling peaches bring but 50 cents a bushel, while grafted fruit commands $1.50. A neighbor, Mr. C. Ringlestein, from the crop of 300 trees, received $1,100, besides appropriating a large quantity to family use. He finds the Moorpark, Kaisha, and Peach Apricot the best varieties of that fruit. The tree is a late bearer, not producing before its eighth or tenth year, but its subsequent crops are large and profitable. The fruit ripens before any other of the early peaches. Pears flourish best when grafted upon quince stocks. All kinds of fruit grow luxuriantly on irrigated land. Mr. Ringelstein is very successful in his culture of the Black Spanish grape, which he prefers to cultivate upon a single pole, without espaliers, according to the old Roman custom. He made a very good wine, last year, from this grape, and from the Riessling.

Mr. W. W. Ross, Dallas, Dallas County, has 18 acres in apples, pears, peaches, and apricots. The last-named fruit has proved entirely worthless; the fruit from blossoms, which escaped the spring frosts, was mostly destroyed by the curculio. The other fruits, however, have all proved very profitable. He has produced 200 to 300 bushels of peaches per acre—Hale's Early, Cole's Early, Tillotson, Amelia, Crawford's Early, &c.—realizing $1.50 to $4 per bushel. His apples—Astrachan, Carter, Rhodes's Orange, &c.—have produced 300 to 400 bushels per acre, realizing $2 to $3.50 per bushel. His pears yielded 200 bushels, worth $3 to $5 per bushel.

Peaches are cut off every third or fourth year by frosts. Apples bear full crops, alternating with partial crops. Pears are very certain to yield a good crop. The best market varieties of apples and peaches are those named above. Of pears, the best are the Bartlett, Louise Bonne de Jersey, and Seckel. Mr. Ross has also 3,500 grape-vines, mostly Catawba, 400 acres. His grapes are all made into heavy bodied wine, yielding about 600 gallons per acre, worth $2 per gallon. No loss reported from mildew; some from rot and insects, wasps and bees, and very considerable loss from birds. Best market grapes, Hartford, Iona, and Warren.

Mr. W. W. Bowen, of the same locality, from a young peach orchard, realized about $300 per acre. His losses from insects were about 25 per cent. of the crop. The best market varieties are early peaches and winter apples. He obtained 25 cents per pound for grapes the past season, but lost three-fourths of his crop through rot. His best market varieties are the Concord and Hartford Prolific.

Mr. John Summers, Jefferson, Marion County, has 1,000 vines on 7 acres, yielding 250 bushels per acre, worth $8 per bushel. The Scuppernong is the leading variety. All kinds of vines are thrifty growers and vigorous bearers. The soil needs no very expensive cultivation.

ARKANSAS.—No reports of specific enterprises in fruit culture have been received from this State. We have, however, several communications from correspondents, stating in general terms the capabilities of that part of the country for fruit culture.

TENNESSEE.—Reports of fruit culture from this State are also few and meager. Increased attention to this branch of business was manifested a few years prior to the war. Within the last three years the subject has been attracting renewed attention. Immense numbers of trees and vines are now received from northern nurseries, while native nurseries are being established in different counties, looking to a still increasing demand for trees. Peach culture has rapidly increased in some localities, and peaches are beginning to bring more remunerating prices than formerly. Other branches of fruit culture have also increased, but not at so rapid a rate.

Mr. E. Link, Greeneville, Greene County, has twenty acres in apples, peaches, plums, and cherries, planted from 1856 to 1861. Much of the fruit in the older orchards of the county is perishing with "bitter rot." The Golden Pippin is the best market apple, though there are several other varieties of great excellence.

Mr. J. W. Sparkman, Eagle Tannery, Wayne County, speaks of a red rust which infects the leaves of some fruit trees, increasing until vegetable life is destroyed. The young summer growth of many trees is also detroyed by an unknown insect.

Mr. W. Critchfield, Chattanooga, Hamilton County, has ten acres in apples, pears, peaches, and plums, planted in 1866 and 1867. His orchard yields about one thousand bushels of fruit, worth, on an average, about $1 per bushel. Of market peaches he heads the list with Hale's early, especially when grown upon a warm, dry soil. For home use and for canning he prefers the Amelia and St. John; for shipping, Early Tillotson, Early Crawford, and Early Nutmeg. The best market apples are Red June, Early Harvest, and Red Astrachan. Northern winter apples become fall apples in this climate. Several small orchards and vineyards belonging to amateur cultivators, or grown merely for home consumption, are mentioned in the correspondence feom this State, but present no facts of general interest in regard to fruit culture.

A FEW FACTS FROM FLORIDA.

Perhaps no other Southern State has of late attracted so much attention as Florida. Its peninsular position, low latitude, almost tropical temperature, and its peculiar shape, which gives a seashore border to twenty-one of its thirty-nine counties, combine to give to this State a character *sui generis*. Its uniformity of temperature makes it the Italy of America—a *sanitarium*, especially for consumptives and others unable to endure the rigors of northern winters; and its semi-tropical climate allures the adventurous who desire a wider range of rural industries than northern farming or fruit-growing affords.

Not only do ocean or Gulf waters lave a majority of the border counties, but inland seas furnish water-transit and modification of climate to most of those in the interior. The eastern border of the State, for nearly all of its five or six degrees of latitude, is supplied with channels of water communication—the Indian River, which is a long and narrow bay, separated from the Atlantic by a ribbon-like beach of sand, and the Saint Johns, farther inland and more like an actual river, as it receives the waters of a large number of streams, and swells into broad lakes or assumes the semi-marine character of an ocean frith.

It is claimed that the climate of South Florida resembles those of Madeira and Barbadoes, both esteemed as resorts for invalids, having a temperature warmer than that of the former and cooler than that of the latter. The comparison is as follows:

	Barbadoes.	Maderia.	Fort Dallas.	Fort Meyers.
	Degrees.	*Degrees.*	*Degrees.*	*Degrees.*
Spring	79.2	65.6	74.7	75.4
Summer	78.5	71.3	81.5	82.4
Autumn	82.1	69.0	76.3	76.9
Winter	78.5	65.8	66.6	65.4
Yearly	79.5	67.9	74.8	75.0

Fort Dallas is at the mouth of the Miami River, on Biscayne Bay, near the Atlantic Ocean, a little below the twenty-sixth degree of latitude; and Fort Meyers is at the mouth of the Caloosahatchie River, which embouches into the Gulf of Mexico. Both were military stations during the Indian war. Fort Meyers, though a little farther north, has an annual mean temperature one degree higher than that of Fort Dallas. The following are the monthly means of these points:

Months.	Fort Dallas.	Fort Meyers.	Months.	Fort Dallas.	Fort Meyers.
	Degrees.	*Degrees.*		*Degrees.*	*Degrees.*
January	66.4	63.4	July	82.1	82.9
February	66.6	68.0	August	81.8	83.1
March	70.4	72.2	September	79.6	81.7
April	75.6	73.8	October	77.9	77.7
May	77.0	80.1	November	71.3	71.5
June	80.5	81.2	December	66.8	64.7

The record of rain-fall is suggestive of fruitfulness, and shows how the poorest sands are made to yield abundantly the richest fruits and plethoric vegetables. Several of the stations named in the following table of temperature and moisture had above fifty inches of rain during 1871:

Florida.	JANUARY.				FEBRUARY.				MARCH.			
	Maximum temperature.	Minimum temperature.	Mean temperature.	Rain-fall.	Maximum temperature.	Minimum temperature.	Mean temperature.	Rain-fall.	Maximum temperature.	Minimum temperature.	Mean temperature.	Rain-fall.
	Deg.	*Deg.*	*Deg.*	*In.*	*Deg.*	*Deg.*	*Deg.*	*In.*	*Deg.*	*Deg.*	*Deg.*	*In.*
Port Orange	76	34	61.1	......	79	34	52.3	......	82	43	61.6	......
Jacksonville	82	32	59.3	1.05	80	28	55.5	2.25	84	38	61.2	5.4
Pilatka	84	29	59.6	2.38	78	30	56.3	5.29	84	36	61.8	6.36
Ocala	89	22	60.8	1.12	79	32	......	......	86	28	62.1	......
Manatee	82	42	67	3	78	40	61.7	2.2	80	46	66.2	4.40
	APRIL.				MAY.				JUNE.			
Saint Augustine	......	......	......	......	90	60	76.2	......	92	68	79.1	3.10
Port Orange	86	44	64	......	......	......	......	......	......	......	......	......
Jacksonville	91	39	67.2	3.2	95	60	75.7	1.5	96	71	79.2	8.10
Pilatka	94	38	67.9	1.38	......	......	......	......	98	72	81.1	7.8
Ocala	92	40	63.4	......	96	55	71.4	......	95	65	80.2	......
Manatee	86	52	69.7	1.7	92	70	79	2	92	74	83.5	4.5
Orange Grove	85	50	67.7	2.3	88	65	76.4	2.1	90	71	80.5	5.4
Newport	......	......	......	......	94	58	74.2	1.29	92	69	77.8	6.88
Chattahoochee	......	......	......	......	99	47	......	......	95	66	......	6.5
	JULY.				AUGUST.				SEPTEMBER.			
Saint Augustine	22	72	81.5	2.5	94	76	85.3	0.4	90	70	78.4	7
Port Orange	89	72	79.2	4.8	88	73	80.6	2.08	86	68	77.6	11.88
Jacksonville	97	76	84.1	2.65	94	77	84.4	4.4	93	71	77.2	9.38
Pilatka	98	74	82.4	4.16	96	72	82.3	1.13	96	68	79.4	11.04
Ocala	......	......	......	......	......	......	......	......	96	68	81	......
Manatee	94	74	83.1	11	......	......	......	......	......	......	......	......
Orange Grove	92	73	82.1	9.55	94	76	82.6	7.05	90	74	80.7	6.57
Newport	91	70	77.9	2.77	93	73	80.2	2.65	89	68	76	7.02
Chattahoochee	96	72	86.1	3.2	95	70	8.4	5.5	90	69	79	2.91
	OCTOBER.				NOVEMBER.				DECEMBER.			
Saint Augustine	88	54	75.6	......	......	......	......	......	......	......	......	......
Port Orange	84	55	74.2	13.16	78	35	63.2	2.02	76	25	55	3.3
Jacksonville	87	52	73	7.10	85	40	62.7	4.29	73	19	53.3	1.95
Pilatka	90	52	74.7	4.32	90	38	64.6	3.6	80	22	51.6	3.11
Orange Grove	88	57	75.8	9.75	......	......	......	......	......	......	......	......
Newport	84	48	68	2.45	81	29	57.3	2.6	70	9	49.9	2.15
Chattahoochee	......	......	......	......	......	......	......	......	87	15	......	9.5

INCREASE OF POPULATION.—The population of Florida is increasing with considerable rapidity, numbering 187,748 in 1870; in 1860, 140,424. The colored population has increased from 62,777 to 91,689; the white from 77,746 to 96,059. Of the total population only 4,067 are foreign-born, and 109,554 are natives of Florida, 28,058 of Georgia, and 7,334 of Alabama. The remainder, less than one-fourth of the whole, are immigrants from every State except Nevada and Oregon, and all parts of Europe. From New England 1,256 have been received, and 1,050 from New York, 192 from New Jersey, and 312 from Pennsylvania. Immigration will probably increase in the future in much higher ratio.

The inducements offered to immigration by the resources of this State are peculiar and attractive; yet immigrants will enter the State, as others have entered the most favored sections, only to be disappointed. The diseased and the discontented are doomed to disappointment there as elsewhere. Expecting Italian skies, they are occasionally confronted with frost, and are buffeted by chilling northern winds; looking for

fruits and flowers, they can see only the desolation of sandy pine woods; seeking a land of plenty, they find that care and labor are requisite, here as elsewhere, to the purchase of abundance. Yet it cannot be denied that this region offers advantages which few other sections of the country present. One is the opportunity to engage successfully in the cultivation of oranges, lemons, pine-apples, dates, bananas, figs, and many other semi-tropical fruits, and a large variety of other products, which can only be grown in a climate in which frosts are few and slight.

The sugar-cane has long been a source of profit in Florida, and should be cultivated more extensively. While but one-seventh of the sugar of the country is produced within it, there is an open field for continued extension of this profitable industry. The cultivation of garden vegetables, for northern markets, furnishes another opportunity for profitable enterprise; but it should only be undertaken by those acquainted with the business and with the requirements of the markets to be supplied; otherwise disastrous failure might result, as the past few years have repeatedly demonstrated. As a temporary resource, there is a large profit in lumbering and in the pasturage of sheep and cattle; and many an immigrant will find employment of his time and capital and large pecuniary returns for both from the different branches of these industries.

The message of Governor Harrison Reed, delivered January 4, 1872, claims that the increase of population during the past three years has been nearly 40,000, mainly as a result of the labors of the immigration bureau in exhibiting systematically the peculiar resources of the State. He especially calls attention to the fact that "eleven hundred miles of sea-coast, prolific of oysters, fish, and turtle almost beyond parallel, with bays and inlets, and inland navigable waters of an equal extent, offer the richest inducements to enterprise and capital." The State constitution favors the poor by providing that a "homestead to the extent of 160 acres of land, or the half of one acre within the limits of any incorporated city or town, owned by the head of a family residing in this State, together with $1,000 worth of personal property, and the improvements on the real estate, shall be exempted from forced sale under any process of law."

AREA.—Florida is a larger State than Iowa or Illinois, containing an area of 59,268 square miles, or 37,931,520 acres. Concessions of these lands for works of internal improvement by Congress have been very liberal; and such lands can be obtained, in many instances, at rates lower than those required for State or United States lands. There have been sold, according to the records of the land-office, 1,832,431 acres; entered under the homestead law, 389,147; granted for military services, 465,942; officially approved under railroad grants, 1,760,468; approved as swamp lands given to the State, 10,901,207; granted for internal improvements, 500,000; granted for schools and universities, 1,000,663; granted to individuals and companies, 52,114; granted for deaf and dumb asylums, 20,924; confirmed private land claims, 3,784,303. The quantity of land remaining unsold June 30, 1871, was 17,262,459 acres. This is less by 160,979 acres than the area unsold June 30, 1868.

PRICES OF LAND.—At the close of the war the value of Florida lands had declined fully one half. The following is the result of a canvass of this subject through the Statistical Division of the Department of Agriculture:

From the northern tier of counties Jackson and Leon report an average decline of 75 per cent. in the value of farm-lands since 1860, and Liberty 50 per cent., while in Duval interior lands have declined 20 per cent., but on the Saint John's River

have advanced one-third in value since the date named, and in Baker the estimated increase is 50 per cent. Alachua county shows a decline of 50 per cent. The next county south reports no change since 1860, our correspondent remarking that but few persons there own the land they live upon, the custom being to "settle in the woods," put up a log-house, clear a small tract, and plant it for a few years, and when it begins to get poor, move into the woods again, or move about where the range is good for cattle. There are, however, some fine farms near the county-seat, where good corn and some cotton are raised. The value of improved lands is increased by cow-penning. The land is worth from $5 to $20 per acre. Good pine-land can be bought at $5 per acre, with houses, fences, &c. Still farther south, in Manatee County, bordering on the Cypress swamp regions, lands are rated at one-half the estimated value in 1860. In fact, throughout the State, the prices now given for farming lands are merely nominal, consequent upon the unsettled state of affairs, and comparatively few sales are made. The average decrease for the State, on the basis of these returns, is 55 per cent.

There is a large area of wild or unimproved lands in the State held at figures varying from 10 cents to $8, averaging from $1 to $2 per acre. In Jackson, the unimproved lands are claimed to be better than the nominally improved—will yield from 10 to 20 bushels of corn, or from 600 to 1,000 pounds of seed cotton to the acre, and may be purchased at from $1 to $2 per acre. In Liberty the average value is given as low as 10 cents; land low, sandy hummock, capable of producing oranges, sugar-cane, corn, potatoes, rice, and long cotton. Leon, $1.50 per acre; quality medium, fair, while fresh, easily cleared and cultivated, and will produce 20 bushels of corn, or half a bale of cotton per acre, and by a little manuring can be kept up to this. Baker County, $1.50 per acre; very productive for cotton, sugar-cane, potatoes, vegetables, &c. Duval County, average 50 cents per acre. In Alachua nearly all the wild lands are owned by the State, the General Government, or railroad companies. State lands are held at from 50 cents to $8, mostly at the former. United States lands are only in the market as homesteads, and railroad lands vary in price from $1 to $2.50. The land is principally "pine-barren," considerable heavy pitch-pine, interspersed with cypress swamps, and in sections hummocks, the latter being very rich. The greater part of the land, however, is valuable only for timber and turpentine. In Levy the wild land is chiefly timber, and valued according to its location. A portion of this land is comparatively worthless, consisting of sand hills and scrub-lands, covered with brush, and filled with a variety of wild animals; and people living adjacent are compelled to keep gangs of dogs for protection. There is plenty of Government land upon which to settle, some of it the best hummock land, capable of yielding an average crop of 40 bushels of corn; price, from $1 to $5. Manatee County also has considerable hummock lands of first rate quality, underlaid with marl, worth from $5 to $10 per acre. The timber of the hummocks consists of live-oak, hickory, cedar, bog, &c., while the pine is the turpentine, or long pine.

Messrs. McGrath & Perry, editors of the East Florida Banner, of Ocala, Marion County, report the present price of wild lands in that vicinity at $1.25 per acre, improved lands ranging upward to $10. They estimate the normal rate of production at 30 bushels of corn per acre, 100 bushels sweet potatoes, 300 to 500 pounds of sea island seed cotton, or 1,000 pounds of sugar, or 10 barrels of syrup. The editor of the Advertiser, Monticello, estimates the price of wild lands in that county at $1.25, and cultivated lands from $3 to $15, averaging $5. He thinks a fine opportunity is presented to industrious settlers. The freedmen are purchasing land there in small lots. He formerly lived in Ithaca, New York, and upon a comparison of natural advantages greatly prefers his new home.

THE LUMBER BUSINESS.—An extensive and extending business in manufacturing lumber is indicated by the correspondence of the Department. One of the largest of these enterprises is located on Perdido Bay, on the Gulf coast, and managed by Chicago men, who contemplate the erection of saw-mills capable of manufacturing 30,000,000 feet of lumber per annum. It is proposed, in connection with this movement, to complete the Perdido Railroad from its present terminus, on the west side of Little Bayou, to Perdido Bay. Saw-mills are springing up on every navigable water-course and line of railroad, and immense revenues will in the future be derived from this industry.

The report of Mr. Judah, a well-known railroad engineer, thus refers to the value of these lands, especially for lumbering purposes:

One great advantage which these lands possess over Western lands lies in their ability to produce six great staple productions, the most valuable known, and of which the supply cannot equal the demand, while the western lands produce but two great staples, viz: wheat and corn. The construction of the road also gives the advantage of a market on both the Atlantic and the Gulf of Mexico.

These staples are yellow-pine lumber, turpentine, cotton, tobacco, sugar, and rice, in addition to which may be enumerated, among other productions, hay, corn, oats, potatoes, oranges, bananas, figs, peaches, quinces, and many other tropical fruits, which can be grown nowhere else in the United States as well as here.

Nearly the entire body of these lands is covered with a dense growth of yellow-pine lumber of a quality unsurpassed by that of any other State in the Union. The principal lumber trade of Florida is carried on from Santa Rosa County, nearly the entire population of which is engaged in and dependent upon this trade for their support. Some of the largest and finest lumber mills anywhere to be found in the United States are in operation in this county, the principal among which are located upon the Blackwater River, in the vicinity of the town of Milton, which is situated near the mouth of the Blackwater and at the head of the navigable waters of Pensacola Bay.

The amount of lumber annually shipped from this district is about 50,000,000 feet, yielding upward of $500,000 to the manufacturers, and costing the mill owners, delivered in the log, upward of $40,000. The logs to supply their lumber are principally cut upon the margins of the Blackwater and Yellowwater Rivers and their tributaries. The cutters seldom go farther back than one and a half miles from the margins of the rivers. The timber on the margins of the rivers is smaller and not of so good quality as that growing farther back.

CHARACTERISTICS OF SOIL.—Florida contains a great variety of soil; the pine-lands, which are sandy and poor, yet productive with judicious fertilization, easily worked, and precisely adapted to the production of fruits and vegetables; the hard-wood lands, known as "hummock lands," are very fertile, rich loam, based on marl or clay, more difficult to clear than pine-lands, and less favorable to health; and the swamp lands, which are extremely rich in decomposed vegetable matter, productive and valuable when drained, though little occupied as yet. Exhaustive treatment of the pine-lands soon ruins them, but rational management, with the use of abundant and cheap fertilizers, as lime, marl, fish-guano, and the droppings of cattle, will secure large and undiminishing returns. The treeless sections are known as savannahs. The swamp lands are deemed the best, the "low-hummock," or swamp hummock, next, the "high-hummock" third in order, (though first in desirability, as they are less expensive in preparation for cultivation,) followed by the different classes of pine-lands. The soil of the "low hummocks" is deep, tenacious, and durable, but requires ditching for successful cultivation. The "high hummocks" have an undulating surface, with a deep soil of vegetable mold and sandy loam, resting upon limestone, clay, or marl. These lands are suited to a great variety of crops, and have yielded three hogsheads of sugar per acre. Large bodies of these hummock lands are found in Levy, Alachua, Marion, Hernando, and Sumter counties. Mr. Adams, commissioner of immigration, estimates the area of first-rate sugar-lands in Levy at one hundred thousand acres.

THE "KEYS."—Mr. W. C. Maloney, jr., editor of the Key West Dispatch, informs us that the Florida Keys, or islands, from Key West northerly to Cape Florida, (most of them a part of Monroe County,) furnish few agricultural products for exportation with the exception of pine-apples, tamarinds, and cocoa-nuts, the former of which fruit is raised in considerable quantities on Key Largo and Key Matacomba, and that on all the keys the guava, banana, plantain, sugar-apple, soursop, orange, lemon, lime, grape-fruit, citron, cocoa-nut, tamarind, alligator-pear, and sapadilla are raised, and all kinds of West India fruits; also sea-island cotton and indigo can be grown.

At Key West all the above-named fruits are grown, together with the

date and fig; the cocoa-nut, tamarind, and pine-apple are the only fruit capable of shipment, the others decomposing too rapidly after becoming ripe. The price of wild land is about $50 per acre, which can be obtained only on Key West, the other keys being reserved by the Government, and as yet unsurveyed. Key West and Boca Chico furnish the only cultivated lands which can be sold, the prices varying from $500 to $1,000 per acre, according to the stock of fruit growing. Sisal hemp is raised on all the Florida Keys, and is a valuable product. Aloes and palma-christi grow with little or no cultivation on all the keys.

Vegetables can be raised in the winter season, such as potatoes, cabbages, beets, turnips, &c., for which there is a good market at the city of Key West, which contains about 6,000 inhabitants and has a commerce of some importance.

There are various keys to the westward of Key West, and within a like semi-tropical climate, where all the enumerated fruits are or can be raised profitably, and vegetables in great profusion. The population of South Florida has greatly increased since the close of the war, and settlers are coming in rapidly.

IMPROVEMENTS TO FACILITATE TRANSPORTATION.—The facilities for water transportation are remarkable; the coast-line is one thousand two hundred miles in length, and the interior abounds in lakes and rivers, the principal streams being the Saint John's, Saint Mary's, Ocklockonee, and Indian Rivers, which facilitate communication through all sections of the State. Railroads are extending their lines and new lines have been projected. The projected Southern Inland Canal, from New Orleans to the Atlantic, across Mississippi, Alabama, Florida, and Georgia, would save hundreds of miles of dangerous voyaging around the Florida coast and millions of dollars in losses, salvage, and other wrecking expenses avoided. At the National Commercial Convention held in Baltimore in September, the committee on interior lines of water communication reported as follows:

Whereas recent surveys, conducted by individual enterprise, have demonstrated the practicability of making the whole valley of the Saint John's accessible to sea-going vessels of heavy draught by giving a channel of eighteen feet in depth through Nassau Inlet: Therefore,

Resolved, That the improvement of the navigation of Saint John's River is a matter of national importance, and worthy the attention of all interested in general commercial prosperity, for two main reasons:

First. The existing railroad systems, with less than two hundred miles of additional construction, will reach through Florida, Alabama, and Mississippi, from Jacksonville to New Orleans, and will thus complete the eastern portion of that grand southern transcontinental railroad system to which the South is fairly entitled, and which is destined to become one of the great avenues of travel and transportation from the Atlantic westward, reaching out, on the one hand, to India, China, Japan, and the farthest isles of the East, and, on the other, gathering in the rich harvest of South American commerce.

Secondly. Through the channel of the Saint John's and the inner lake region of Florida a path is opened for that important line of southern inland transportation, traversing the Gulf States and touching New Orleans, Mobile, and Pensacola, by means of which some measure of relief may be afforded to the valley of the Mississippi, now suffering and stagnating under the immense weight of its own surplus productions, unprofitable through their immovability, while an adequate exit may be given through the channel suggested, by a canal whose cost of construction shall not exceed the annual aggregate loss on western produce, through insufficiency and expense of existing means of transportation.

PRODUCTION.—A comparison of the census returns of 1860 and 1870 shows some changes in production and in the value of farms. The decrease in the size of farms is significant. In 1860 the average size was 444 acres; in 1870, only 232 acres. The number of farmers in 1870 was

10,241; in 1860, 6,568; in 1850, 4,304. The unimproved land in 1850 was 78.1 per cent. of the total area reported in farms; at the next census, the percentage was 77.6; and at the recent census, 69 per cent.

The value of live stock is little changed, though the numbers are less; but orchard products have increased 150 per cent., and the products of gardens more than 50 per cent., though the figures are probably far short of the real aggregate in each case, these minor products not being fully returned. There has been a marked increase in the rice product, but cotton, tobacco, and most other farm-crops have been reduced. The new comers are busy in building houses, planting orange groves and orchards, and making improvements, the results of which are not seen in the census-returns. A comparison of these results with the status in 1860 follows:

	1870.	1860.
Improved land .... acres..	736,172	654,213
Woodland .... do....	1,425,786	....
Other unimproved land .... do....	211,583	2,266,015
Present cash value of farms	$9,947,920	$16,435,727
Cash value of farming implements	$505,074	$900,669
Wages paid, including board	$1,537,060	....
Value of farm productions, including betterments, &c.	$8,909,746	....
Orchard products	$53,639	$21,259
Products of market-gardens	$31,983	$20,828
Forest products	$7,965	....
Home manufactures	$131,693	$63,259
Value of animals slaughtered or sold for slaughter	$520,966	$1,193,904
Value of all live stock	$5,212,157	$5,553,356
Horses .... number..	11,902	13,446
Mules and asses .... do....	8,835	10,910
Milk-cows .... do....	61,922	92,974
Working oxen .... do....	6,292	7,361
Other cattle .... do....	322,701	287,725
Sheep .... do....	26,599	30,158
Swine .... do....	158,908	271,742
Spring wheat .... bushels..	....	....
Winter wheat .... do....	....	2,808
Rye .... do....	545	21,306
Indian corn .... do....	2,225,056	2,834,391
Oats .... do....	114,204	46,899
Barley .... do....	12	8,369
Rice .... pounds..	401,687	223,704
Tobacco .... do ...	157,405	828,815
Cotton .... bales..	35,366	65,153
Wool .... pounds..	39,909	59,171
Peas and beans .... bushels..	64,846	363,217
Irish potatoes .... do....	10,218	18,766
Sweet potatoes .... do....	789,456	1,129,759
Wine .... gallons..	681	336
Butter .... pounds..	100,989	408,855
Cheese .... do....	25	5,280
Milk .... gallons..	3,002	....
Hay .... tons..	17	11,478
Cane, sugar .... hogsheads..	952	1,669
Cane, molasses .... gallons..	344,339	436,357
Beeswax .... pounds..	6,052	10,899
Honey .... do....	50,884	115,520

FARM ANIMALS.—The cattle of Florida, as those of Texas, are of almost unmixed Spanish origin, and maintain characteristics of marked uniformity. They are of slow growth, requiring five years to attain full maturity. They have long horns, like the Texans, are round-bodied, clean-limbed, very active, difficult of taming, and dangerous of approach by a person on foot, and sometimes even on horseback. The Indians of Florida, in the days of their occupation of that country, subsisted upon the proceeds of stock-raising, except as they relied upon fishing and the chase. They prevented, by severe measures, if necessary, the annual burning over of the range which has become prevalent under white occupancy, and saved from destruction the most succulent and nutritious of the grasses. Large herds then occupied the open pine woods and the

richer hummock lands. There are still large herds numbering thousands each, and reports are current that 40,000 cattle are marked with the brand of a single individual. The best range is in South Florida, where verdure is perennial, and there are found the largest herds. The cattle-owner generally lives in a simple way, upon Government lands, and cultivates nothing more than a garden-patch, not always owning the land upon which his cabin is placed; and yet the income of these cattle lords is in many instances princely.

The number of cattle in Florida, in 1860, according to the census, was 388,060; in 1870, 400,915; the population at the former date was 140,424; at the latter, 187,748; therefore a comparative decrease is shown, 277 cattle to each 100 people having been reduced to 213 in 1870. Cattle can yet be very much increased there, but large herds will eventually be displaced by smaller lots, improved, better kept, and better fed. The cow-pea is a mine of wealth in forage-production, grown at little cost, two or three crops in the year. Roots grown late in autumn and winter pastures of rye are valuable helps, and corn, sorghum, millet, and lucerne can be cheaply grown. Few States can equal the prodigal provision of nature in Florida, when man is willing to do his part.

In Northern Florida frost kills the grass and renders some provision necessary for large herds. The Department correspondent for Suwanee County says, "The wire-grass was killed worse than usual by the frost, (almost as bad as in the Northwest,) and was not sufficient to keep cattle without other food;" in Gadsden County, "Left to shift for themselves" entirely, they have suffered the past winter for want of food and protection; in Manatee, where "They have the same range winter and summer," cattle are reported thin, and some have died in consequence of a backward season and late springing of the annual grasses; in Santa Rosa one-eighth died from a similar cause; and so of the counties of North Florida generally in the winter of 1871–'72, showing that in the mildest of climates cattle will not live and thrive without something nutritious to eat.

SUGAR-CANE.—One of the most reliable and profitable of Florida pursuits is the manufacture of sugar and molasses from cane. The business is evidently to be greatly extended in the immediate future. The hummock lands produce excellent crops and the yield of fertilized pine-lands is quite remunerative. Letters of correspondents, regular and casual, abound in references to this subject. At Manatee, on the plantation of Messrs. Edwards & Foster, the cane last season averaged in height twelve to fifteen feet, with forty to fifty joints, "most of it as large as a man's wrist." It was all used as plant-cane, for 60 to 70 acres, on which a crop of 2,000 to 3,000 pounds of sugar per acre is expected. Mr. John V. Brown, of Columbia County, reports seventeen barrels of sugar and nine barrels of sirup from two acres of cane. In 1868, in Volusia County, Mr. George Soulé is reported to have made sugar, sirup, and molasses to the value of $500 from three-fourths of an acre of pine-land, obtaining high prices, viz: 15 cents per pound for sugar, 75 cents per gallon for sirup, and 50 cents per gallon for molasses.

Mr. John L. Crawford, of Crawfordsville, Wakulla County, writing concerning the mode of culture of sugar-cane and its yield and profit, says that Mr. A. P. Tully, a practical planter and reliable gentleman, reports that he has finished dripping his sugar crop of only one acre, the result of which is 3,400 pounds of dry sugar of good quality and 160 gallons of molasses. The land on which this crop was produced lies within one mile of Crawfordsville, the county-seat of Wakulla County, and it is not above second quality; it is called "scrub-land,"

neither pine nor hummock, the soil light and sandy. The acre in question was cowpenned in the spring of 1870, and in June it was cleared, ridged, and planted with sweet-potatoes, yielding a large crop. In February last it was thoroughly broken and laid off in rows five feet apart, in which 60 bushels of cotton-seed was sprinkled, worth 10 cents per bushel in that market. The sugar-cane was cut in pieces about two feet long, and dropped, end to end, breaking each joint with another piece, so that a cane six feet long, cut in three pieces two feet long each, would plant four feet. The culture given was only two plowings and hoeings, deemed quite sufficient in new land. Mr. Tully ground one sugar-cane which yielded half a gallon and a gill of juice. The greater portion of the crop matured eight feet.

There are three kinds of sugar-cane produced in Wakulla, viz, the green, red, and ribbon. There is local division of opinion as to the relative value of the canes. Mr. Crawford says the green grows larger, is softer, and makes superior sugar and sirup, but the seed does not keep well, comes up badly, and is more liable to be injured by the cold; that the red cane keeps better, comes up more surely, ratoons better, stands the cold better, and is, perhaps, better adapted to that soil and climate than the green or ribbon; and that the ribbon cane is, in every particular, the medium between the green and the red. Mr. Tully produces the ribbon. On the last of October or the 1st of November, the planters dig up their seed-cane, spread it on the ground, in banks about six feet wide and one foot high, covering it immediately two to four inches with earth. It is usually dug up in, or immediately after, a shower of rain, to prevent it from taking the dry-rot. The smallest cane, with the shortest joints, is selected for seed.

Mr. W. F. White, of Tampa, Hillsborough County, says that sugar-cane is cultivated in small patches there, principally for home use, but holds that experience has proved it to be the field-crop for that part of the State. "On pine-land it will yield a fair crop; if cowpenned land, the yield will be liberal. On rich hummock land the best crops are raised, ratooning successfully for eight or ten years; and those who have experience on pine-land say that with plot-culture and plenty of manure the cane will ratoon as long as on the hummocks. The pine-lands produce the best sugar; hummock, with marl foundation, will not produce sugar, but makes superior sirup, as it can be boiled very low without sugaring. The average yield per acre in sugar is about twelve barrels. It requires from five to seven gallons of juice to make one of sirup. In planting cane it takes 1,500 canes to plant one acre; anything that is six feet long is considered a cane. I have some cane twelve feet long taken from ordinary pine-land, cowpenned. On Manatee River, in Manatee County, on our plantation, in 1854, Major Gamble raised and manufactured 250 tons of first-class sugar."

Mr. F. L. Dancy furnishes statements showing the yield of cane in the neighborhood of Orange Mills, Saint Johns County, for the year 1871. Mr. C. Masters, on Moccasin Branch, planted and cultivated three and a half acres of pine-land, cowpenned, with the labor of himself and horse. The product was 42 barrels of sugar, (220 pounds per barrel,) or 9,240 pounds, at 8 cents per pound, $739.20; 600 gallons of molasses, at 40 cents per gallon, $240. This gives a total of $979.20, at the rate of $279.77 per acre. In addition to this he raised corn, peas, and potatoes for his home consumption.

Mr. Joseph Masters, Moccasin Branch, planted two acres of pine-land, cowpenned, with labor of himself and horse. The product was 23 barrels of sugar, or 5,060 pounds, at 8 cents per pound, $404.80; 300 gallons of

molasses, at 40 cents per gallon, $120; giving a total of $524.80, at the rate of $262.40 per acre. He also raised corn, peas, potatoes, and vegetables for family use.

Frank and Tina Triay, McCulloch Branch, planted two and a half acres of cowpenned pine-land, with their own labor, and the product was 19 barrels of sugar, 4,180 pounds, at 8 cents per pound, $334.40; 270 gallons of molasses, at 40 cents per gallon, $108; a total of $442.40, at the rate of $176.96 per acre.

Mr. John Rodgers, McCulloch Branch, planted three acres of pine-land, cowpenned, and cultivated with the labor of himself and one horse. The product was 43 barrels of sugar, 9,460 pounds, at 8 cents per pound, $756.80; 600 gallons of molasses, at 40 cents per gallon, $240; a total of $996.80, at the rate of $332.26⅓ per acre.

Mr. Gideon Yelvington, on the sand hills, planted one and a half acres pine-land cowpenned, and the product was 20 barrels of sugar, 4,400 pounds, at 8 cents per pound, $352; 300 gallons of molasses, at 40 cents per gallon, $120; a total of $472, at the rate of $314.66 per acre.

Mr. John Simms, Pellicer's Creek, planted three acres pine-land, cowpenned. He ground one acre of cane and saved the rest for seed. Product of one acre, 17 barrels of sugar, 2,740 pounds, at 8 cents per pound, $219.20; 250 gallons of molasses, at 40 cents per gallon, $100; a total of $319.20 from one acre.

Mr. J. B. Hazel, of Putnam County, planted one and three-quarter acres old pine-land, cowpenned, the only fertilizer, and cultivated it himself with the aid of one horse. His product was 18 barrels of sugar, 3,960 pounds, at 8 cents per pound, $316.80; 200 gallons of molasses, at 40 cents per gallon, $80; giving a total, at the rate of $226.75 per acre, of $396.80.

ORANGE GROVES.—The growing of oranges requires time, patience, and some degree of skill; they have two enemies, frost and the scale insect. Neither is a discouragement sufficient to drive a persistent man from his work, or an obstacle to pecuniary success in the long run. There need be no fear that orange-growing will prove unprofitable from increase in production; the business is at present in its infancy. It is reported that there are several groves recently planted on the Saint John's, and now coming into bearing, one of which now contains more trees than all the groves on the river contained prior to 1867. The average Florida orange is of far better quality than those received from foreign countries, and the finest known varieties have been introduced for the purpose of improvement.

Mr. B. H. Hart reports a grove, three years from budding, which yields fifty oranges to each tree. He has himself several trees that bore in 1871, the third summer after budding. On Orange Lake a grove of seventy-two acres is reported, owned by a Mr. Means, and seedlings sufficient to increase his area to one hundred and fifty acres.

Mr. W. F. White, of Tampa, reports a number of flourishing groves, and states that trees begin to bear in five to seven years from the seed, and at ten to twelve years old are in full bearing.

Hon. F. L. Dancy, of Orange Mills, Saint John's County, writes concerning his crop of 1871:

My bearing grove consists of forty trees, twenty years old and forty, six years old From these trees, covering but little over one-half acre of ground, I shipped for market 58,250 oranges, which netted me 2¾ cents each, or $1,600, after paying for nails and lumber for boxes. My twenty-year-old trees had not what I call a full crop for trees of their age; some had as many as 2,500 to the tree, others not more than 800 to 1,000, not having fully recovered from the freeze of 1868. My young trees, six years old, had from 200 to 600 and 800 per tree. The above are facts which those who desire to en-

gage in the orange culture in this part of Florida may rely on. If there is profit enough in it to induce any to come and enter into it, I say come one and all, for I have no fear of overstocking the market. We want competition in this as well as in other business.

MISCELLANEOUS PRODUCTS.—The variety of plants capable of being grown in Florida, for their fruits, for fiber, for medicinal purposes, and for uses in various arts, is very large, but it is not proposed to present a list of them here. From the correspondence of the past few months a few items has been culled, merely as hints of the wide capabilities of Florida for profitable and various products.

A gentleman writing of experiments in pine-apple culture, at Clear Keys, South Florida, says:

Recently we have been making some experiments with pine-apples. The difficulty with us has been to procure seed. Recently a company has been canning them at Cedar Keys. They have them brought fresh from Cuba by the returning New Orleans steamers. From these we can procure seed. by using the suckers growing around the fruit. These are not so thrifty as those coming up around the roots, but we find they do very well. The trials made have succeeded beyond our expectation. They grow more readily than cabbage-plants, do not require so much care, are not exposed to as many accidents or enemies, and when once fairly set continue to grow and bear for years without replanting. I have now eight hundred growing vigorously, and expect to increase my planting as rapidly as I can procure seed. I hope to have a fair crop next May and June.

Bananas and pine-apples are reported as doing well in the southern part of Volusia County, though they cannot be relied on in the northern portion. The commissioner of immigration has succeeded in producing fine bananas in his garden in Alachua County.

A lemon was recently plucked from the plantation of Rev. Dr. Lee, at Manatee, 12½ inches in circumference in one direction, 14½ in the other, weighing 19 ounces.

Mr. A. B. Grunvell, of the Advertiser, Monticello, Jefferson County, has a high opinion of the crab-apple of Florida. The tree grows to the height of 20 feet, is symmetrical in shape, blossoms early, bears heavily, and matures its fruit before frost, which is in size about an inch in diameter, too acid for eating but excellent for jelly, and is not known to be injured by insects.

Wild fruits of many kinds are abundant: the dewberries, blackberries, huckleberries, several varieties of the Scuppernong class of grapes, the persimmon, the mulberry, &c. In Gadsden County, 1,000 gallons of Scuppernong wine per acre are reported.

The Carolina vanilla plant, or "deer's tongue," (*Liatris odoratissima*,) grows in great abundance in Florida, and has been made, in some degree, an article of commerce. It is used by tobacconists for flavoring smoking-tobacco, and, if properly cured, with the expenditure of a little effort in extending a knowledge of it, might become an article of some commercial importance. A letter, embodying this opinion, was recently received from William Grange, of the imperial Ottoman consulate at Baltimore. It has been shipped from Pilatka, Putnam County, to a considerable extent. Between September 4, 1871, and January 20, 1872, 39 bales were shipped from Silver Springs, Maricn County. It was sold in Savannah at 20 cents per pound, but the demand declined, either from temporary over-supply or from careless gathering and curing.

In Columbia County, a field of sea-island cotton, twelve acres, owned by Mr. J. V. Brown, brought $2,000 at 95 cents per pound the present season.

At Manatee, Messrs. Edwards and Foster are planting ramie on a large scale, being convinced, from experiments, that it is the most profitable fiber that can be grown in the State.

INTRODUCTION OF THE JUTE PLANT.

During the year a number of successful experiments in jute cultivation have been reported to the Department from various sections of the South. A farmer in Plaquemines Parish, Louisiana, makes the following statement:

About the middle of May last I received from the Department of Agriculture two varieties of jute-seed, one from Calcutta, the other from the south of France. I planted on the 1st of June and sowed in drills sixteen inches apart. In a few days the plants appeared and grew rapidly. In three months the French jute grew nine feet and the Calcutta over ten. The French specimens threw out numerous branches and a dense foliage, while the Calcutta has no branches and but few leaves. I believe this plant will thrive in Louisiana.

Samples of both sorts were planted in Cameron County, Texas, in a very dry soil, and had no rain from the date of planting to September 19. It with difficulty germinated, and attained only the height of fourteen inches. A correspondent from Matagorda County, Texas, writes:

I distributed the jute-seed among our best planters, but it came too late, and was planted when the plants should have been in bloom. The two varieties—French and Indian—are quite distinct. From what I see I much prefer the India, which grows more like hemp, or flax, and has a pod about three or four inches long, growing on the stalk, and limbs something like the okra. The pod is full of seed, and in diameter the size of a man's little finger. The India plant grew on our sandy prairie soil, in a severe drought, five or six feet high, while the other kind, planted on strong bottom-lands, grew ten or fifteen feet high. The latter throws off limbs and branches, and to my mind is objectionable on that account. Its seed grows in little buttons. I believe soil and climate here suit the plant. I made no effort to gather the fiber, which will require experience and investigation.

Augustus F. Leory, of New Orleans, writes to the Department under date of March 11:

You were kind enough last year to send me several papers of jute-seed. These I planted myself on my place, seventy miles below this city, on the banks of the Mississippi River. In three months the plants grew, with little or no cultivation, ten feet high. They fully matured, and produced abundance of seed. I am now fully satisfied that jute can be produced throughout all the sugar-growing portions of the valley.

A correspondent in Charleston, South Carolina, writes:

Last season I received from the Department some jute-seed which I planted at Summerville, twenty-two miles from this city. The seed was not planted until June 10, and was on very poor land, but by October 1 the plant had attained a height of six feet. This fully demonstrated to me that the cultivation of this fibrous plant can be a success in the South.

Mr. Thomas F. Chapman, of Red River Landing, Point Coupee, Louisiana, says:

My Calcutta jute-plants grew from twelve to sixteen feet high. The seed-pods grow on the stalks and limbs. I am now perfectly satisfied that soil and climate here suit the plant, and believe, when fairly introduced, it will be grown in this country as long as cotton is grown. I deem it almost as great an acquisition to the country as cotton itself. It yields one of the cheapest fibers nature produces.

Hon. E. H. Derby, of Boston, who has long been interested in this subject, sends to this Department the following communication:

Ten years since, I was led to appreciate the value of this plant, and to write an article in the Atlantic Magazine, in which I pointed out its merits. Soon after this I sent an order to Calcutta for a supply of seed, and when it arrived I planted a portion of it in my garden on the sea-coast, where it grew, but did not mature. A portion of the seed, planted farther from the sea, germinated, and the plants rose to the height of two or three feet, but the season proved too short for them. The residue of the seed was sent to the Department of Agriculture for distribution in the more southern States; but being then in its second year, it either failed to germinate, or did not reach its destination.

While acting at Washington as a commissioner of the Government upon our relations with Canada, I made it my business to visit the Department of Agriculture and

inquire after the jute-seed. The result of my visit was a second and more successful order, transmitted by the Department to India, for a new supply of seed in 1869, and followed by another order sent to France. I have now to congratulate you upon the success of the Department in obtaining the seed, upon its distribution at the South, and upon the production of jute in our Southern States, where it is now acclimated.

Letters published by the Department, and others addressed to me, give the gratifying information that the jute attained its full height of ten to twelve feet, and ripened its seed last year in Texas and Louisiana. The planters, however, were still at a loss as to the best mode of planting, the season for gathering, and the steps to be taken to separate the fiber from the stem. To obtain this information, I addressed a letter to the agent of the Tudor Ice Company, at Calcutta, Mr. R. Macallister, and received a very full reply, as follows:

"The seeds are sown in the months of March and April, broadcast, on plowed land, preference being given to moist high ground, situated, if possible, on the bank of a river, and somewhat sandy. As a general rule manure is not used, but animal dung has been employed to advantage; nor is it necessary to irrigate the ground, as no more water is required than is sufficient to keep the roots moist, for which the ordinary showers of this country generally suffice. It is allowed to grow three to four months, and is cut in the months of June, July, and August, when it has attained a height of seven and a half to twelve feet, the size depending, of course, on the fertility of the soil and the season.

"The time chosen for cutting is just after the flowers have turned to seed, and before the seeds begin to ripen; for it is found when cut thus early to be of better color and to have less root. When the seeds are allowed to ripen it appears that the fiber becomes stiff and hard, and the inferior portion of the stem changes color, becoming blackish or reddish.

"When cut, the stalks are tied in bundles and thrown into tanks of dirty water and allowed to remain there five to eight days to rot, (the dirtier the water the faster, I believe, the rotting process takes place,) at the expiration of which time they are taken out and the fiber falls from the stick. The fiber is then hung up to dry, and when dry is assorted, packed in round bundles called drums, and sent off.

"The finer qualities of jute sometimes attain a height of fifteen feet. The smaller the plant the lower the quality. The seeds are used for cultivation only. They contain very little oil, and no one has ever thought it worth while to crush them, neither have they ever been tried for feeding poultry or cattle. Small plants yield more seeds than the larger ones, and supposing all the plants on an acre to be allowed to ripen, the yield of seed would be about 120 pounds, as I am informed."

The South now possesses the seed, the mode of culture, and the knowledge of the fact that jute attains to the full size of that grown in India, in at least two of our cotton States. The South will be interested to learn that in India jute is fast gaining upon cotton, and that the annual export of it from India to Europe and America bids fair soon to exceed the export of cotton.

The production of cotton in India was greatly stimulated by the high prices incident to our late war; but, since its conclusion, it has been checked by a decline of prices. Jute, on the contrary, though it also received a *stimulus* from the war, still continues to increase. It is the cheapest fiber produced, and on that account has been and still is extensively used as a substitute for cotton. In India the field which in ordinary years returns but 69 pounds of cotton to the acre yields 552 pounds of jute, and is more easily cultivated when in jute than in cotton. Jute-seed is sown broadcast in the spring, and when the plant has attained its full height, but before its seed ripens, it is cut and laid for a week in some pool or river, when the outer bark peels off. The fiber is then shaken from the stem, and as soon as it has been dried by the sun it is ready for sale or use. The stems, like willow branches, are used for basket-work.

The cotton fabrics from the looms of England have broken down the cotton manufacture, once carried to great perfection in India, but the manufacture of jute is replacing it. Its manufacture requires little capital, skill, or machinery. "The Indian widow" still sits upon the ash-heap, and weaves the sackcloth largely used in America to envelop both grain and cotton. Although the export of cotton from India continues nearly stationary, the export of jute from that country shows an increase from about 300,000,000 pounds, in 1870, to 450,000,000 in 1871, thus showing the remarkable gain of 50 per cent. in a single year. Should such gain continue for another year the export of jute in 1872 will exceed in weight the export of cotton. This conclusion is sustained by the following tables. The British one is taken from the London Economist of November 11, 1871, and the American from the last annual report of the Bureau of Statistics for the fiscal year ending June 30, 1871:

Importation of jute from the East Indies into Great Britain during the first ten months of 1871 and 1870: In first ten months of 1871, tons 134,228; value £3,296,384. In first ten months of 1870, tons 98,309; value £1,912,492. Imports of jute into the United States in fiscal years ending June 30, 1871, and June 30, 1870: In 1871, jute raw, tons 26,450. In 1870, jute raw; tons 19,049. Jute imported from India in

gunny-cloth and bags into the United States, in 1871, 30,124,466 pounds; in 1870, 8,781,753. The whole value of jute, both raw and manufactured, imported from India into the United States, was, in 1871, $5,362,988; in 1870, $3,155,271. We may safely infer from these tables that the exportation of jute from India to the United States during the past fiscal year increased more than 70 per cent., both in volume and value, and that the entire export from India to Europe and America now exceeds 450,000,000 pounds, costing in India more than $25,000,000.

Jute is applied to a variety of uses. Much of it is used in carpets and other fabrics as a substitute for wool, cotton, flax, and hair. When it is landed in the United States, jute and the fabrics composed of it are increased in cost by heavy charges for freight, insurance, duties, profits, and interest; and the bale-cloth is more than doubled in cost by these and other charges, before it reaches the cotton-press. Most of these expenditures may be avoided by the planter, if he will devote to jute a part of his cotton-fields. By doing so he will accomplish several important objects: First. Its culture will introduce a diversity of pursuits. There is a strong tendency to over-production in cotton. Three millions and a half bales of cotton yield larger returns than four millions; and if he diverts from the cultivation of cotton to jute a force sufficient to produce half a million of bales, the crop of jute will be nearly a clear acquisition, and will save a large outlay for freight, bale-cloth, and compression of cotton. Second. Cultivation of jute will save several millions sent out of the cotton States every year to purchase gunny-cloth, and will furnish a large surplus for home consumption and exportation to Europe. Third. If in India jute can be produced for one-eighth of the cost of cotton, while it sells for one-fourth of the price of cotton, it must yield large profits, and can be raised with still larger profit at the South where it escapes freights, duties, and other charges, and commands a higher price. It has been in very quick demand, and now sells in Boston from 6 to 7 cents per pound. Fourth. If jute is fast gaining upon cotton and superseding it to some extent, the Southern States will surely be in the rear if they do not keep pace with India in this branch of agriculture. Fifth. Apart from the preceding considerations, jute would employ the female labor of the South, which retires from the cotton-field under the system of free labor. It would give employment also to the field-hands when driven from the fields by the inclemency of the seasons.

The simple machinery used in Kentucky for spinning and weaving hemp might be applied to jute, and be in many cases set in motion by the power now used for ginning and compressing cotton. In the present posture of affairs it is the policy of the South to save all the jute-seed raised the present year, and to send a large part of it to the Department of Agriculture; while it should pay particular attention to the production and manufacture of jute in the coming season.

The following is a statement of the imports of jute, and similar fibers, in the fiscal year ending June 30, 1871:

Raw, 26,450 tons, valued at	$2,131,056
Manufactures of, 228,873 square yards, valued at	28,556
Gunny-cloth and other bagging, 30,124,466 pounds, valued at	1,468,902
Other manufactures, valued at	1,734,474
Total	5,362,988

Here is an importation amounting to $5,362,988, most of which might be obviated, and a new agricultural industry created which might eventually become an important ally of, and complement to, the cotton interest.

The quantity of coarse fibers required in this country becomes larger annually. A large amount of the fiber, of the heavy flax of the West, which is grown almost exclusively for the seed, has of late years been utilized as a substitute for jute in cotton bagging and other cheap material for bags. Should jute culture become a naturalized industry a wonderful enlargement of its present list of uses would occur, and a great development of its production would be assured. The Department of Agriculture will foster this enterprise by every available means.

STATISTICS OF THE DAIRY.

The report of the American Dairymen's Association for 1871 exhibits 1,283 cheese and butter factories in the United States, against 1,234 reported in 1870, and 1,066 reported in 1869. Of these establishments about 55 per cent. present statements of the number of cows employed, showing an average of 415 cows for each factory. The following averages are exhibited in States leading in dairy manufactures, viz., for each factory in New York, 419 cows; Ohio, 519 cows; Illinois, Massachusetts, Vermont, and Michigan, collectively, 383 cows; Wisconsin, 278 cows; Pennsylvania, 182 cows. The numbers of dairy factories in these States are reported as follows: New York, 963; Ohio, 98; Illinois, 46; Massachusetts, 30; Vermont, 35; Michigan, 26; Wisconsin, 40; Pennsylvania, 19. These annual lists are incomplete, but give a fair indication of the growth of the associated dairy system from year to year.

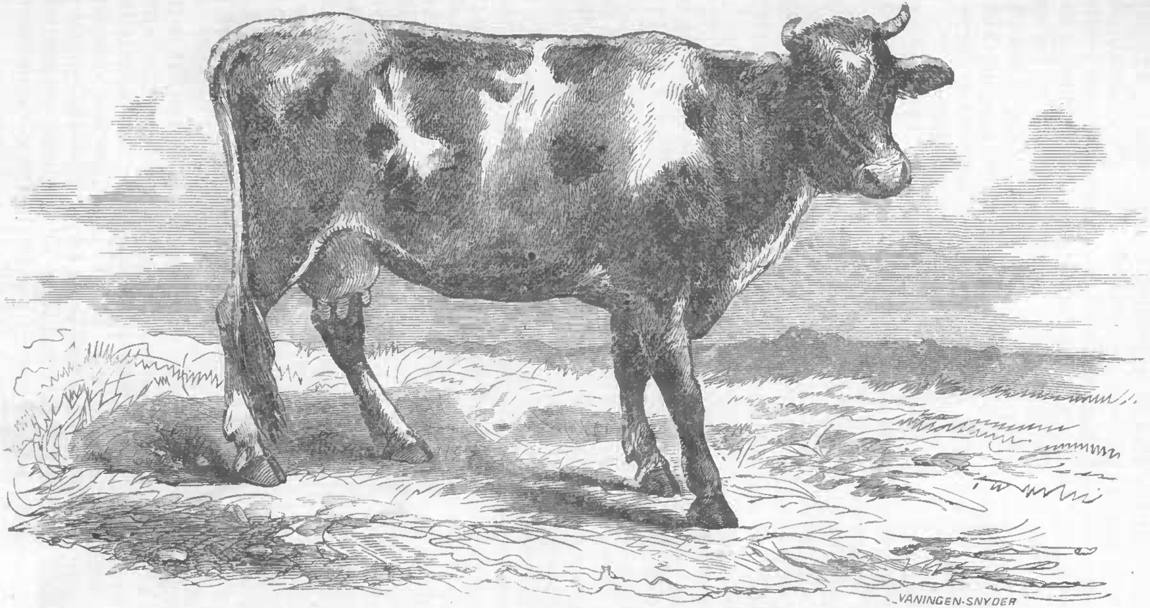
The cheese of 1871 has been superior to that of the preceding year, of which the midsummer manufacture was so greatly affected by the extreme heat; but the losses experienced during the season of 1870 from imperfect curing of cheese have enforced attention to this latter point, and current dairy publications are contributing to improvement in this respect, by presenting plans of cheaply-built and effective curing-rooms, ice-houses, &c., accompanied with minute discussions of details of management. Mr. L. B. Arnold, of Ithaca, New York, after stating that the united testimony of careful experimenters has proved that 70° of Fahrenheit is the proper temperature for curing cheese, points out the injuries which have resulted from deviations from this standard. Manufacturers sometimes allow green cheese to stand for a few days, in rooms where the temperature is too low, supposing that thereby only a delay in ripening is involved, whereas the best experience has shown that anything which checks, even temporarily, the progress of the curing process, is damaging to the character of the cheese. A temperature which is too low tends to make the cheese hard, dry, and flat in taste; on the other hand green cheese, when exposed to a temperature of 80° to 90°, will swell with gases, and will ripen too rapidly, developing bad flavor.

The increase of manufacture and the decrease of prices during the years of 1870 and 1871 have led experts not only to study the means of improving the average character of American cheese, but also to consider specially the adaptation of styles and shapes to the demands of the trade, and all methods which promise reduction in the expenses of marketing cheese. More skillful manufacture has also reacted in greater efforts to secure the best condition of the milk product. The advantages of the home-rearing of milk stock; the practice of soiling as a preventive against the diminution in quantity and depreciation in quality of milk usually experienced during summer extremes, and especially in dry seasons; the often reiterated need of the most perfect cleanliness of milk-vessels, and of milk-rooms free from impure odors—points not yet fully appreciated by many milk producers—have been presented in the most forcible manner, and illustrated by conclusive statements of experience.

DAIRYING IN VIRGINIA.

Several cheese factories have recently been erected in Virginia, and an increased number may be expected at an early day. No State promises a better profit for capital invested in associated dairying. The Old Dominion cheese factory at Hamilton, Loudoun County, Virginia, was

PLATE XVIII



COW, "JERSEY DUTCHESS."

Imported in 1870; three years old. Color, silver gray; fawn, black, and white. The property of Thomas S. Kennedy, Fair View, near Louisville, Ky.

established in May, 1871. The amount of milk received from May 6 to September 8 was 378,138 pounds; amount of cheese manufactured, 36,625 pounds; average quantity of milk required for one pound of cheese, 10.3 pounds; average value of cheese at the factory, $12\frac{7}{8}$ cents per pound, the product being of excellent quality, notwithstanding the severe drought of the season. The superintendent, Mr. J. K. Taylor, says that it must be conceded that Virginia is admirably adapted to dairying, and that the production of milk, butter, and cheese would pay the farmers of the State vastly better than the present exhaustive system of cropping with grain and tobacco.

Mr. Taylor, reporting on the sales of cheese, butter, milk, and calves from his dairy of 8 cows, for the season commencing May 7, and closing December 12, states the net receipts over current expenses at $387.19, averaging $48.40 per cow. From Mr. T. R. Smith's dairy of 10 cows, near Lincoln, Loudoun County, 2,640 pounds of cheese were made during the season of 1871, netting $273.81. Amount of butter made, 970 pounds, bringing an average price of 30 cents per pound; value of 10 calves, $61.40; average return per cow, without deduction for cost of manufacturing butter, $62.62. Mr. E. J. Smith's dairy, near Lincoln, varying from 10 to 11 cows, reports an average of $46.03 per cow for the season, without deduction for cost of making butter. Mr. B. W. Welsh's dairy, near Circleville, in the same county, reports an average return of $43 per cow.

The low price of land in Virginia, in comparison with the best dairy districts in Pennsylvania and New York, the abundance and quality of grasses in the best locations, the length of the grazing season, and the comparatively small amount of winter forage required, combine to render the business profitable here. Improvement in the milking qualities of cows, and a better acquaintance with their proper management, will increase the cash value of the product per cow, which is now comparatively low.

GROWTH OF THE DAIRY INTEREST IN OHIO.

The Wellington (Ohio) Enterprise gives the following statement of shipments of cheese from Wellington, for five years past: In 1867, 2,740,400 pounds; 1868, 3,136,448 pounds; 1869, 3,355,914 pounds; 1870, 7,978,039 pounds; 1871, 9,071,603 pounds.

The growth of cheese manufacture in Medina County, Ohio, is shown by the following summary from the Medina Gazette: Amount of cheese made at twenty-three factories in 1871, 3,223,491 pounds; amount made by private dairies, 200,000 pounds; total, 3,423,491 pounds; making an increase of 686,791 pounds over the product of 1870. The value of the cows employed in 1871 amounted, at an average estimate of $35 each, to $318,500, and the value of the cheese product is placed at about $300,000.

The statistical report of the secretary of state of Ohio exhibits the butter product of that State, in 1870, at 43,020,554 pounds, showing an increase of 4,236,947 pounds over that of 1869, and of 8,957,623 over the average of the decade from 1860 to 1869, inclusive. The cheese product for 1870 was 31,381,038 pounds, showing an increase of 10,860,870 pounds over that of 1869, and of 11,291,052 pounds over that of the decade commencing with 1860.

HOME-BRED STOCK.

At the meetings of dairy associations during the last two years experts have strongly advised that dairymen should raise their own

milk stock, instead of persisting in the current practice of purchasing to keep up the number of the herd; and it has been repeatedly and authoritatively asserted that, even though "coming in" at a somewhat greater cost than a purchased animal, the home-bred cow, under proper management, will give decidedly the larger profit. Statements recently put forth by dairymen in different parts of New England and New York go to sustain this proposition, some of these having been found included in evidence offered on other questions of practice. An experienced milk-producer of Middlesex County, Massachusetts, states to the Department that in his own region, at average prices of hay, the cost of a home-bred cow, coming in at twenty-eight or thirty months of age, would be fairly estimated at $50; and that, though long accustomed to recruit his herd by purchase, careful observation has of late led him to the conclusion that the opposite method is the preferable one. In Herkimer County, New York, and in other prominent dairy districts of that State, the method of home-rearing of milk stock appears to be gradually gaining favor among practical men; and the Western New York Dairymen's Association, at their meeting at Buffalo, in May of the current year, passed a unanimous resolution approving this policy. The cost of raising a "good cow" was estimated at about $40—considerably less than the price of a purchased cow of equal value. The importance of males of pure blood was earnestly insisted upon. In a recent address before the Ohio Dairymen's Association, Mr. J. H. Klippart deprecated the current system of recruiting the herd by purchase, adding that the best animals could not be obtained in this way. Where dairymen chose to continue this course, he advised adherence to the German rule: "Purchase the animal when in calf, never a cow with a calf, nor a cow in milk, since a cow driven from a farm where her calf was dropped will diminish her yield of milk."

George Geddes, of New York, well known for his thorough acquaintance with the best English and American agriculture, after enumerating the evils attendant on the practice of purchase, expresses his surprise that American farmers should be deterred from raising their own dairy stock, and remarks that no other system of recruiting the herd gives such opportunity for increasing the value of the cows and the fertility of the farm; and that this is the current practice of farmers in all the midland counties—"bringing the heifers into the dairy herd, and fattening off the cows in turn, so that they never have any inferior old cows to dispose of."

PROFITS OF SOILING.

Mr. H. Sedgwick, of Cornwall, Connecticut, stated at the farmers' meeting at Lowell, Massachusetts, in September, that farmers in his neighborhood were engaged in producing milk for the New York market. Referring to the short feed of the fall of 1871, he added:

> Our farmers all declare they will never go back to the old way of feeding stock. We cut up our straw and everything available. Many of us have adopted the plan of steaming the food for our cattle, and we are satisfied from the experiments we have made that we save a third of our provender by steaming it. As a sample of what this manner of feeding stock will do, I will relate an instance of a young man who, a year ago this last spring, bought a farm of 80 acres of land for $11,000. The farm then kept 11 cows, 4 or 5 yearlings, and a horse or two. The young man took hold of that farm and immediately put in 14 acres of sowed corn. He increased the stock to 25 cows, and kept them on 12 acres, feeding them the sowed corn, and also cutting his oats green for food. His receipts the first year wese over $3,000. This year he has summered on that same farm 27 cows, and he told me the other day that his 27 cows would average him $100 each from the profit on milk.

The following is a statement made by Mr. L. B. Arnold, of New York:

When land was cheap, grazing only was thought of for the summer keep of all kinds of farm stock. But as land has grown dear, farmers have endeavored to feed their stock from fewer acres, and have resorted to soiling in the dry part of the season. In the older dairy districts soiling has been slowly growing in favor with dairymen, until it is now considered an essential part of their summer feed. In view of the high price of land and the uncertainty of the seasons it is deemed both unprofitable and unsafe to rely on grazing alone.

A report by Mr. C. L. Sheldon, for the Sulphur Spring cheese factory, Lowville, New York, covering the season of 1870, illustrates the losses ensuing from the imperfect system of summer feeding hitherto customary. The season commenced May 3 and closed October 21, and the number of cows was 720. The average yield per cow for the season of 1870, which was characterized by extreme drought, showed a decrease of 17 per cent. from that of the corresponding term of 1869. May, 1870, showed a gain of 5 per cent. over May, 1869. The other five months exhibited, respectively, a diminution from averages of corresponding months of 1869, the percentage of loss attaining its height in July, and then gradually falling through the rest of the season. Results of manufacture also proved an inferiority in the quality of the milk.

IMPURE WATER.

Complaints of neglect to provide dairy animals with pure water continue frequent in factory reports, and some experts assert that to the stagnant and impure water which farmers often virtually compel their cows to drink, more than to any other cause, is to be attributed the difficulty in turning out a first quality of cheese. At the opening of the present year, in an address before the American Dairymen's Association on the subject of tainted milk, floating curds, &c., Mr. John R. Chapman, of Madison County, New York, stated that, during the first five years of the cheese factory system, cheese-makers encountered but little of the fetid fermentation which has been found to so large an extent among factories during the last three years. The factories of the former years were chiefly in regions of good grasses supplied with running streams of spring water. Now, large numbers of factories are established on low, wet, swampy, sour lands, and on lands where the cows drink from stagnant ponds. However skillful a cheese manufacturer may be he cannot make really good cheese in a region where such imperfect conditions of milk production exist.

SKIMMED-MILK CHEESE IN 1870.

Mr. E. S. Munson, superintendent of the Franklin Creamery, Franklin, New York, in his report for the season of 1870, commencing May 15 and ending October 15, states the average number of cows at 880; pounds of milk received, 2,310,569; pounds of butter made, 78,459; pounds of cheese, 124,966. The average price of the butter, delivered at the railroad seven miles distant, was nearly 39 cents per pound, and the average price of the cheese in May, August, September, and October was $8\frac{1}{2}$ cents per pound. The June and July make, of poor quality, was sold on a market glutted with similar material, and brought 2 to 5 cents per pound, one ton being entirely worthless. Taking the season as a whole, the patrons netted $1.33 to $1.35 on each 100 pounds of milk. Putting the average weight per quart, wine measure, at $2\frac{1}{5}$ pounds, the report shows a net return of nearly 3 cents for each quart of milk supplied.

NET RECEIPTS FOR MILK.

The following reports for 1870 give examples of net prices realized by patrons for milk delivered by them at factories in New York—Weeks's factory, Verona, employing 700 cows, or an average of 600 cows for the

season, commencing April 11 and closing November 4: average price of 100 pounds of cheese, \$14.28; net price returned to patrons for each 100 pounds of milk, \$1.24$\frac{1}{2}$. Valley factory, Stockbridge, employing an average of 475 cows: average price of 100 pounds of cheese, \$13.87; net proceeds to patrons for 100 pounds of milk, \$1.20$\frac{3}{4}$. Sulphur Spring factory, Lowville: average gross value of 100 pounds of cheese, with whey butter added, \$13.74; average net value of 100 pounds of milk, \$1.18$\frac{4}{5}$. Taking 2$\frac{1}{5}$ pounds as the average weight of one quart of milk, the net proceeds of each quart of milk in the respective cases were 2$\frac{3}{4}$ cents, 2$\frac{2}{3}$ cents, and 2$\frac{3}{5}$ cents. The report of Asahel Burnham's factories at Sinclairville and Arkwright, Chautauqua County, for the same year, states that the season commenced April 1 and closed November 19. Number of cows employed, 1,734; average price of 100 pounds of cheese, \$13.23; net proceeds of 100 pounds of milk, \$1.13$\frac{2}{5}$, (or 2$\frac{1}{2}$ cents per quart.) The average price received for each 100 pounds of cheese during the last seven seasons was \$14.52, and the average net value of 100 pounds of milk was \$1.33$\frac{1}{3}$, (or nearly 3 cents per quart.) The report of Weeks's factory for 1871 states the average price of 100 pounds of cheese at \$11.93, and the net return to patrons on 100 pounds of milk at \$1.01$\frac{1}{6}$. The Sulphur Spring factory reports, for 1871, the average gross value of 100 pounds of cheese, with whey butter added, \$11.72$\frac{1}{2}$; average net value of 100 pounds of milk, \$1.04$\frac{1}{5}$.

BUTTER-MAKING IN FACTORIES.

No question connected with the dairy is more vital to the interests of producers and consumers than that of the best management of butter. The current expressions of dairymen in different portions of the country, both east and west, show a thorough conviction of the necessity and practicability of a general application of the factory system to the manufacture of butter.

Mr. O. S. Bliss, secretary of the Vermont Dairymen's Association, states that having watched with much interest the working of co-operative butter manufacture, he has found it successful in every instance within his knowledge. As to the necessities of water, &c., a good spring or well, and suitable rooms and apparatus, contribute as much to the highest success of the co-operative system as to that of farm manufacture, and no more; but particular provision must be made against injury from the practices of careless feeders, such as are to be found in every community of milk-growers. As to the disposal of the skimmed milk, Mr. Bliss holds that the best course is to feed it out to pigs and calves, thus turning it into meat and manure, rather than to work it up into skim-cheese. Mr. I. H. Wanzer, manager of a butter and cheese factory at Elgin, Illinois, well known as a skillful dairyman, says that while western cheese has attained a respectable standing in the general market, western butter, the weight of which is believed to amount to five times that of cheese, has a very unenviable reputation. There is greater need of reform in the staple of butter than in any other product of the Northwest, and there is no doubt that butter factories, properly established, will be the most effective means of this reform. There is no danger of overstocking the market with butter of a superior quality, and it should not be forgotten that the manufactories to a great extent absorb small dairies without materially increasing production. But Mr. Wanzer concludes, from careful observation, that factory making of butter and cheese can be successfully carried on only where an abundant flow of running water is secured, and where the milk is supplied by patrons living within a moderate distance from the establishment; it

being specially important that the milk when received should be sweet and free from injury either by want of care in the hands of the farmer, or by conveyances over long distances in hot weather.

SETTING MILK FOR BUTTER.

The method of setting milk in deep vessels is claimed to give not only greater convenience of handling, but also a better condition of cream than is obtained under the old system of shallow pans. The milk is maintained at a uniform temperature by water flowing below and on all sides of the milk vessels.

Mr. J. W. Irons, manager of a butter and cheese factory in Tompkins County, New York, states that he sets his milk in tin pails, eight inches in diameter and twenty inches deep, in pools filled by a steam-engine, which also gives power for churning and other purposes. Milk for butter alone remains in the pool from sixty to seventy-two hours, at a temperature of 60°. After the cream is taken from the pails it is kept till the next day, at a temperature of 65°, until acidity is developed, and is then put into old-fashioned barrel dash-churns, having a capacity of one and one-half barrel each, and working 50 to 55 strokes per minute, the churning lasting about one hour. Milk set at 64° to 65° gives a little more cream, but causes depreciation in the quality of the butter, while a temperature of 70° results in a very inferior product.

Mr. Wanzer, of Elgin, Illinois, says: "The setters in our factory are six inches in diameter and twenty inches deep, so that very little of the cream is exposed to the action of air and light; cream from these setters makes much better butter than from that set in the ordinary way." From personal observation he is convinced that one of the most frequent causes of poor butter is the improper setting of cream, especially setting in rooms and cellars badly ventilated and exposed to impure odors.

AMOUNT OF MILK TO ONE POUND OF BUTTER.

In factory cheese-making it is found that 9½ or 10 pounds of milk are required for one pound of cheese on an average for the season. The establishment of this fact has settled many questions of dairy economy. While a difference exists in the productive capacity of individual cows in cheese-making, a much greater diversity is apparent in the richness of the butyraceous elements of their milk; and therefore a greater difficulty in fixing an average yield of butter from a given quantity. A collection of recent facts will serve to illustrate the subject, if it shall not fix an average ratio of butter to milk for the aggregate number of American cows.

The manager of a creamery in Onondaga County, New York, receiving milk from 300 cows, tested the number of pounds of milk required for one pound of butter at the close of July, 1870. The delivery of milk on the evening of July 30 and the morning of July 31 amounted to 5,729 pounds, and this was set for about thirty hours, in deep pails, in a tank of spring-water, maintained at a uniform temperature of 53°, after which the milk was removed and exposed to a free atmosphere for eighteen hours. Then, the milk having soured and thickened, the cream was removed and kept till next day, when it was churned, producing 232 pounds of butter, each pound requiring an average of 24.69 pounds of milk. He states that at that season of the year a yield of 1 pound of cheese from 10 pounds of milk is considered very satisfactory. Cheese at that time was worth 14 cents per pound, and after making a small extra charge against the butter, for excess of expense in making and packing, over the cost attending cheese manufacture, he estimated that

it must bring 35 cents per pound in order to pay an equal profit with the cheese.

Mr. H. Cooley Greene, superintendent of a cheese and butter factory at Woodcock, Crawford County, Pennsylvania, made butter exclusively from July 20 to September 10, 1871, using the milk of 700 cows. The milk was set in pails immersed in water, and was allowed to sour before skimming, great care being taken to secure the best possible yield.. The average product was 1 pound of butter from 26 pounds of milk. He has never been able on any one day to obtain more than 1 pound of butter from 23 pounds of milk. He has several times experimented as to the comparative yield of sweet and sour cream, and the uniform result has been that the yield of butter from the sour cream has been one-fifth greater than that from sweet cream.

Mr. Greene also presents the record of a creamery in Tompkins County, New York, which reports an average for the season of 1869 of 1 pound of butter from 27 pounds of milk. The milk was sweet when skimmed, but the cream was soured before churning, and the skimmed milk was converted into cheese.

On September 12, 1870, the Davis cheese factory in Herkimer County, New York, was compelled, by an accident to the boiler, to manufacture into butter one day's receipts of milk, amounting to 4,000 pounds. The milk was set twelve hours, and from the cream was obtained 200 pounds of choice butter, showing, somewhat to the manager's surprise, an average of 1 pound of butter from 20 pounds of milk, which would be equivalent to about nine and one-half quarts.

The Elgin butter factory, Elgin, Illinois, received during November, 1870, 1,480 gallons of milk, averaging, during that period, 1 pound of butter (besides 2 pounds of skimmed cheese) from 12.07 quarts of milk.

The following particulars are from reports for 1871 of butter factories in Franklin County, New York—Barley Spring factory, Chateaugay: first season of operation, May 29 to October 20; number of cows employed, 135; pounds of milk used, 270,811; average amount of milk required for 1 pound of butter, 22.55 pounds. Berry factory, Malone: first season of operation, May 24 to October 28; number of cows employed, 175; pounds of milk used, 425,988; average amount of milk for 1 pound of butter, 25.1 pounds; average price of butter at the factory, 31 cents. The report states that, in the midst of the heated term, the machinery was found defective in respect to thorough cooling of the milk, and that this imperfection caused the average of milk to butter to be larger than it would otherwise have been. The Cold Spring factory, Malone, using 441,267 pounds of milk for the season, averaged 22.31 pounds of milk for 1 pound of butter. The Keeler factory, Malone, (opened June 25,) Horace L. Dickinson's factory, Moira, and the Union factory, Bangor, report their respective amounts of milk for the season at 152,829 pounds, 348,263 pounds, and 233,161 pounds, and averages of milk for butter at 23.72 pounds, 23.13 pounds, and 24.5 pounds. The statement of the latter factory shows that it did not obtain a sufficient supply of water during the hottest part of the season. Consolidating these six statements for the season of 1871, they present an average of 23.48 pounds, or about ten and three-fourths quarts of milk for 1 pound of butter.

A large number of reports of small dairies, or of single animals, have been received, widely varying in quantity of milk to the pound of butter, in some cases showing milk of exceptional richness; but the results in these associated enterprises involving a large number of cows are better guides in approximating a true average of the cows in the best

dairy regions. As the milk of the cows of New York or Ohio is not equal in butter production to that of selected cows in these factory enterprises, the average amount of milk required to make a pound of butter might be placed at 25 pounds for the States in which dairying is prominent. An average for all parts of the country, from the actual results of present processes of butter-making, would probably be as high as 30 pounds.

SYSTEMS OF MILK SUPPLY.

The milk consumption of our larger cities is rapidly increasing, and is extending its demands to the utmost practicable limits along the lines of railroads. It is but a few months since propositions for milk supply were made by New York contractors to farmers distant two hundred and twenty-five miles from that city. The single fact that a difference of one-half cent per quart often represents to the milk producer a difference of hundreds of dollars of yearly income, is significant of the importance of placing the producer of milk in direct communication with the consumer.

At the fourth annual meeting of the Massachusetts and New Hampshire Milk Producers' Association, in December, 1871, a committee, appointed at the previous annual meeting to collect information concerning the management of the milk trade, reported that in February they addressed letters to five principal railroad corporations, making inquiry as to the names of milk contractors on their respective roads, amounts of milk conveyed, and rates of freight or car-rent. Two of the corporations, the Fitchburgh and the Boston and Maine, gave satisfactory replies; two returned no answer and the other declined to give the information, for the reason that to do this would be contrary to the expressed wish of the contractors with which it had engagements. The reply received from the Boston and Fitchburgh road covered the year ending April 1, 1870, and stated the amount of milk carried on the road during that period at 860,881 cans of 8½ quarts each, worth at the country depots, 33⅓ cents per can on an average, making a total of $286,960.33; the cost of freight varying from 1 cent to 3⅛ cents per can. This is equivalent to 7,317,488½ quarts of milk, averaging a value of about 4 cents per quart at depots of shipment, the expense of freight per quart ranging from less than one-eighth of a cent to a little more than one-third of a cent. The committee estimate that, on this road, since April, 1870, the milk business has increased 10 per cent., and state that the milk is sold at the car in Boston at 40 cents per can in summer and at 50 cents in winter; that it is resold, in whole cans, at an advance of 14 cents per can; and that the usual retail price per quart has been 8 cents in summer and 9 cents in winter, more than double its value in first hands. It is found that the net gain of one contractor, after paying expenses of collecting the milk and freight to Boston, amounted to $14,782.50 per year, or $40.50 per day. This is the result of only one profit out of three made on the milk, in its passage from producer to consumer; yet all grades of dealers engaged in the trade aver that their rates of compensation are not more than fair. On many other milk routes the farmer's proportion of the retail price is very small, and payment is often delayed many weeks. Without discussing the reasonableness of the percentages obtained by the several grades of middlemen, the committee conclude that the present system of milk-marketing in that region is not an economical one; they suggest that producers combine and employ a salaried agent to conduct the business, and that milk depots or stores be established in the city, where the milk would be immediately delivered and inspected, the impure or

adulterated being condemned at once, and any surplus, in danger of becoming sour, being disposed of as rapidly as possible. This plan will remove the constant complaints now arising from return of milk on the hands of producers, on account of alleged original bad quality or other reasons given by contractors. The committee do not recommend an immediate radical change of system, but make these suggestions as preliminary to a judicious reform, and advise that the State railroad commissioners be requested to procure from the managers of the several railroads terminating at Boston information as to all contracts for milk transportation over their roads during 1871, showing amounts carried, and from what stations, with names of contractors and rates of freight.

The agitation of the milk supply question in Massachusetts has finally resulted in the establishment of the Milk Consumers' Protective Association of Boston, which went into operation April 1, 1872, supported by two thousand subscribers. Six routes were at once started in the central wards of the city, taking about 300 cans of milk daily; and it was expected by the managers that routes would be opened throughout the whole city by the 1st of May. The milk was sold by tickets, thirteen of which were delivered for $1, making the price per quart nearly 8 cents. Under this arrangement the chief advantage realized by the consumer will be in the purity of the article obtained, an advantage not to be lightly estimated, in view of the exhibits of adulteration presented in recent reports of milk inspection.

A statement showing the manner in which New York milk farmers control the sales of milk by association in "creameries" occurs in a valuable paper on American Butter Factories, contributed by Mr. X. A. Willard to the Report of the Royal Agricultural Society of England for 1871. Mr. Willard states that these creameries were first instituted by milk dairymen, as a special experiment on the associated system, and for the purpose of regular daily marketing of cream, &c., the feature of butter-making being subsequently introduced. At these creameries the members of the association deliver milk night and morning to the manager of the establishment, who negotiates sales, his books being at all times open for examination. Milk is forwarded to the city by a daily afternoon train. Some of the milk is thirty-six hours old on its arrival at the city, and therefore, in order that it may reach the consumers in good condition, it is absolutely necessary that it be skillfully cooled within an hour after milking. The chief characteristic of this cooling process is that, after milking and straining, the milk is put in tin pails eight inches in diameter, and seventeen to twenty inches deep, set in cold, flowing spring-water, the surface of which is kept on a level with that of the milk. It has been found that milk retains its sweetness longer when set in these small pails than when cooled in large cans, as was formerly done. Mr. Willard also gives representations of styles of milk coolers used by farmers, in which milk is cooled at the farm as soon as drawn from the cow. For conveyance in the train, the milk is put in carrying-cans holding 40 to 50 gallons, which are completely filled, no space being left between the cover and the milk. The cream skimmed from a portion of the milk is put up in cans, which are ice-packed for shipment in tubs tapering toward the bottom and carefully covered. The milk and cream are sold to city dealers, who contract for certain quantities for the season. Payments are made weekly or monthly, at the creamery or the nearest railroad station, and the receipts are divided among the patrons.

CONDENSED MILK.

The manufacture of condensed milk continues to be discussed by

dairymen, with a view to future co-operative effort in that direction. The trade in this article has been much increased within the last two years, and has assumed considerable consequence, especially in the milk supply of New York City.

The following summary is from an account given by Mr. Willard of his visit to the milk-condensing works of Mr. Gail Borden, at Brewster's, New York, in December, 1871. The milk, when received at the factory, is turned into vats, whence it is conducted through a hose into copper cans holding 40 quarts each, and set in circular bath tubs furnished with a coil of steam pipe at the bottom, by which it is heated to between 150° and 175°. It is then raised to the boiling point in adjacent heating wells, having a jacketed bottom for steam. Thence it is drawn to a vacuum pan six feet deep, provided with two coils of pipe, with an average steam pressure of 55 or 60 pounds per square inch. The milk is here subjected to a heat of 135° or 145°, and is condensed by evaporation at the rate of 2,000 quarts per hour. The process is then concluded by super-heating to a temperature of 190° to 200°, by which the milk is finally reduced to about one-quarter of its original volume. When "preserved condensed milk" is made, six and three-quarters ounces of sugar are taken for each three pounds of raw milk, and this sugar is turned into a movable well, where it is dissolved by turning on a small quantity of hot milk. This solution is then drawn into the pan and mingled with the mass of milk which has meantime been partially condensed. The factory sends about fifty 40-quart cans of plain condensed milk to New York City daily, where it sells at 40 to 50 cents per quart. Mr. Willard was informed that the production of a good article of condensed milk was found to depend not so much on the best formula of manufacture as on the thorough purity and good condition of the milk when received at the factory, and upon the subsequent cleanliness of handling. In order to secure the best conditions, a strict supervision is maintained over the dairies connected with the factory, and each lot of milk is tested as to cream, sweetness, and keeping quality. The cost of erecting and operating a condensed milk factory, capable of converting 5,000 gallons of crude milk daily, has been estimated at $12,450, of which $2,500 will cover the cost of a building, and $9,950 that of the apparatus in working order. The daily running expenses, including the wages of a superintendent, two laborers, and one engineer, fuel, wear, taxes, insurance, interest, &c., are placed at $24.50. An additional allowance of 4 per cent. on the first cost of the milk is made in order to cover waste in working. This allowance on daily receipts of 5,000 gallons, at a first cost of 12½ cents per gallon, amounts to 200 gallons, worth $25, swelling the daily expense to $49.50. The total expense of manufacture averages a little more than 1 cent on each quart of condensed milk.

A recent paper by Dr. C. F. Chandler, of New York, states that all the hospitals and charitable institutions of that city under the control of the Commissioners of Public Charities and Corrections are supplied daily with condensed milk by the American Condensed Milk Company, Purdy's Station, New York. The agreement made with the company stipulated for the condensation of 430 quarts of good country milk to 100 quarts of the manufactured article. The commissioners having ordered an investigation to test the quality of the condensed milk, Dr. Chandler made a careful examination, and found satisfactory proof that each 100 quarts of the article furnished represented about 450 quarts of good country milk, which was the proportion actually reported by the company to the board. This company supplies condensed milk in quantities of 25 to 100 quarts daily at 30 cents per quart in summer and 35

cents in winter, and in quantities of 300 quarts or more daily, at 25 cents per quart in summer and 28 cents in winter.

Taking Dr. Chandler's report in connection with the estimate of expense of manufacture presented by Mr. Willard, it would appear that the crude milk finally returns an average value of a little more than 6 cents per quart over the cost of conversion. Mr. Willard, however, places the value at a considerably higher figure.

MILK SUPPLY OF SOUTHERN CITIES.

During the spring and summer a circular letter was addressed to residents of various Southern cities asking information upon the following points: 1. Is the milk supply of your city of good quality, and in quantity equal to the demand? 2. Retail prices per quart, summer and winter? 3. Is the supply chiefly furnished by individuals who keep a few cows each, or is it to a considerable extent from large dairies? 4. What rations, in kind and amount, are provided for the animals? 5. Average time per cow in milk, and average yield for the season. 6. Current prices of milch cows of fair quality? 7. What efforts are being made for the improvement of dairy stock in your neighborhood?

Replies were received from Lynchburgh, Virginia; Raleigh and Wilmington, North Carolina; Charleston, South Carolina; Augusta and Macon, Georgia; Mobile, Alabama; New Orleans, Louisiana; Vicksburgh, Mississippi; Little Rock, Arkansas; and Lexington, Kentucky, from which we condense as follows:

1. At Lynchburg, Raleigh, Charleston, Augusta, and Macon the supply is of good quality, and equal to the demand. At Wilmington, Little Rock, Vicksburgh, and Lexington the supply is insufficient, but the quality good. At Mobile the supply exceeds the demand, and the milk varies in quality according to the wishes of customers, some of whom demand a cheap article, even though diluted. At New Orleans the supply of pure milk is insufficient, and, taken as a whole, is of inferior quality. An examination instituted by the city chemist, a short time ago, proved the majority of the samples to be adulterated with 25 to 75 per cent. of water. A few were found pure.

2. Retail prices, per quart, as follows: Lexington, 5 cents in summer, 7½ in winter; Lynchburgh, 8 cents in summer, 10 in winter—to large consumers, hotels, &c., 7½ cents throughout the year; Raleigh, 10 cents in summer, 12 to 15 in winter; Augusta, 12½ cents; Macon 12½ cents in summer, 15 in winter; Charleston and New Orleans, 15 cents; Little Rock, 10 to 15 cents in summer, 20 to 25 in winter; Wilmington and Vicksburgh, 20 cents; Mobile, 20 cents for pure milk, 10 to 15 for diluted.

3. To this question the general answer is, that the supply is chiefly furnished by individuals keeping a few cows each. In Raleigh the citizens, for the most part, keep cows for their own use. At Augusta there are half a dozen milk dairies of 6 to 12 cows each, one of the smaller ones being carried on by an enterprising freedman. In Mobile there are about 1,000 cows kept by families for their own use, who in many cases supply their neighbors. There are also about twenty dairies. In New Orleans there are a few dairies of 50 to 80 cows each. In Lexington the supply is chiefly furnished by persons who keep 5 to 20 cows each. Only one or two farmers make the production of milk a specialty.

4. The answers to question 4 indicate a prevalent "slackness" and great want of economy in the management of dairy animals. Cows pick up a very large share of their subsistence on commons, vacant lots,

and road margins in or near the city, receiving such occasional feeds of wheat bran, peas, hay, &c., as their owners find it convenient to furnish. This appears to be the ruling course, with exceptions of fair management, proper shelter, and generous feeding. The report from Lynchburgh says:

We give our milch cows, daily, one-third of a bushel of mangolds, thoroughly boiled, and 14 to 20 pounds of corn fodder, finely cut, scalded with the water from the boiled roots and sprinkled with ship stuff and corn meal. Corn and sorghum are the principal forage crops grown for dairy animals. The mangold crop yields us 1,200 to 1,600 bushels per acre.

This is a sufficient indication that the land is capable of yielding a liberal and economical food supply. But the general style of management of dairy animals is shown by these further remarks:

The supply is chiefly from town cows. In the summer these are driven half a mile or more from the city to break fences and devour crops; and in winter they are allowed to run at large in the streets and forage from wagons vending hay, oats, &c.

The Raleigh correspondent replies that—

There is no attention paid to the provision of food and shelter. There is very little cultivation of grass; cattle run in the road or browse in the woods. Almost universally, calves suck the cows until nine months or a year old; and there is no regularity observed in milking, cows coming up or not, as they please. It is customary to milk standing, with the right hand, the left hand holding a small vessel to receive the scanty returns. It would be cheaper for citizens to buy their milk than to continue in the present style.

In New Orleans the demands of a large city bring about tolerably systematic feeding. Besides hay there is given, twice or thrice a day, a mixture of distillery slops, with cotton-seed oil-cake, wheat bran, ship stuff, and occasionally corn and oats. In good weather the cows generally run on the commons. It has already been shown that New Orleans milk traders are not behind their brethren in certain northern cities in practices of dilution.

At Lexington, a rich grass region furnishes in abundance, and with little care, the natural food of the animal. The reporter says:

Blue grass nine months in the year, and sometimes through the winter; in winter months bran, hay, corn-fodder, &c. The price of milk is low, and there appears to be not sufficient inducement for a large supply.

5. Lynchburgh: Average time of cows in milk, four to five months, at the close of which period (or when the yield falls to less than four quarts daily) they are fed from four to six weeks and then turned to the butcher. Raleigh: Average yield of the season not more than six quarts per day. Charleston: Many cows are kept farrow and milked continuously for two or three years. Augusta: Average time, eight months; yield, five to six quarts. New Orleans: Average time, eight months; yield, eight quarts. Little Rock: Average time, five months; yield, not quite four quarts. Lexington: Average time, nine to ten months; yield, ten quarts. Many of the best milkers are grade shorthorns and Alderneys.

6. Current prices of milch cows of fair quality. Lynchburgh: $40; Raleigh: $20 to $100; a cow giving four quarts of milk daily will bring $25; eight quarts, $50. Wilmington: $30 to $40; extra cows sometimes bring $60 to $75. Charleston: Cows of fair quality, $75 to $100; but the larger number kept are much below fair, and sell at about $50. Augusta: $50. Macon, $40 to $60; for superior milkers, $70 to $100. Mobile: Common cows, $30 to $50; fine milkers, of improved stock, $100 to $150. Vicksburgh: Most of the cows kept will sell at $30; good milkers at $50 to $60. New Orleans: For fair animals, $80 to $125. Little Rock: $40 to $45. Lexington: $60; really good cows, $80 to $100.

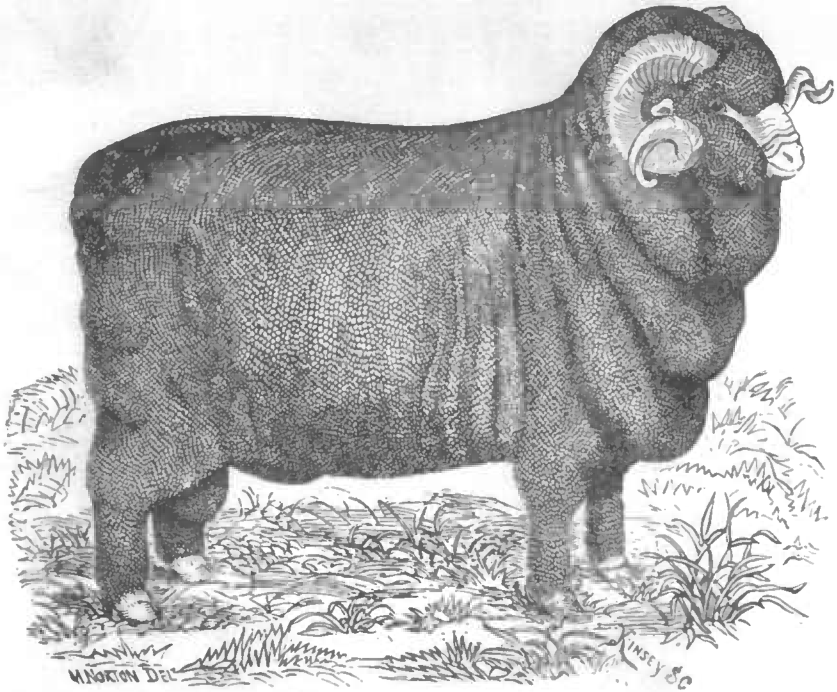
7. Lynchburgh: Some efforts have been made to improve dairy stock,

but cows are generally kept with an ultimate view to beef. The tenor of the reports from Raleigh, Wilmington, Augusta, Vicksburgh, and Little Rock indicates no efforts in this direction. Charleston, Macon, and Mobile: Generally speaking, very little effort; at Charleston, most of those furnishing milk are too poor to buy high-priced stock; at Mobile such attempts as have been made were chiefly spasmodic, dying out after a year or two. New Orleans: There have been some importations of animals of approved breeds from Kentucky, Missouri, and Illinois, but very little is done in breeding. Lexington: Special attention is being paid to dairy stock by crossing short-horns and Alderneys on common blood.

Lexington is in a fine natural grazing region, where the improvement of beef and dairy stock has long been a leading and remunerative business. The milk market of a large city like New Orleans is pretty sure to enforce some thoughtfulness for the animals engaged in its supply, and some attempts to improve the character of the stock. After making all proper exceptions, the general exhibit of these reports is that of almost total want of interest in the improvement of dairy stock and neglect of all proper provision for the stock actually employed—costly indifference to correct methods of supplying a most healthful and important staple of human food. The report of Mr. W. H. Homer, of Mobile, who has been engaged in the milk business for twenty years, indicates a system which may be practiced even in regions unfavorable to the economical feeding of dairy animals. He states that his stock is from imported Ayrshires crossed on the best native cows. Twice a day, at times of milking, namely, 2 a. m. and noon, he gives each animal one half-bushel of a mixture composed of wheat bran and cotton-seed meal, (two parts of the former to one of the latter,) with hay, millet, turnips, and cabbage, cut fine, the four articles last named being grown in large quantities on his own farm. The rations are not cooked, but are thoroughly moistened, or "soaked," long experience having demonstrated that this method insures a larger quantity and better quality of milk. His cows seldom remain dry more than eight weeks. Last year seven of them milked up to time of calving. The average daily yield, per cow, for the whole year, is about 10 quarts. Mr. Homer obtains 20 cents per quart for the milk, which he claims to be as low as pure milk can be afforded at retail in Mobile, the price of feed there being "higher than in any other city." He attributes his success not only to good stock and good feeding, but also to skillful milking—a statement which gains additional force by contrast with the preceding reports of general practice.

The profits of a well-managed dairy are illustrated in the experience of Mr. J. M. C. Reid, near Atlanta, Georgia. His herd in 1871 included 45 cows, the number in milk ranging from 20 to 30, mostly of common stock, though a few possessed an infusion of improved blood. The prices obtained for dairy products throughout the year were, for milk, 12½ cents per quart; butter, 50 cents per pound; buttermilk, 7½ cents per quart. He feeds ground cotton-seed and bran, mixed in the proportion of one part of the former to two of the latter, and finds ground peas especially valuable when obtainable. One of his cows, a grade Ayrshire, was bought by him in 1860, and during the period from April 1, 1861, to June 17, 1871, for which time she averaged 8 quarts per day, the sales of her milk and butter amounted to $4,712.40. At the latter date she was about fourteen years old, and was giving sixteen quarts daily. The record kept shows that the milk brought 20 cents a quart until 1867, from that time to 1869 15 cents, and since the latter year 12½ cents.

PLATE XIX.



MERINO RAM, "DICTATOR."

The property of John Sheldon & Son, Moscow, N.Y. Weight, 160 lbs.; largest fleece, 26$\frac{3}{16}$ lbs.

Mr. Reid maintains a clover-field of 25 acres, of the thin, broken land common near Atlanta, his estimated average crop being over one ton per acre.

This illustration of the possibilities of Southern milk production is supplemented by the declaration of the editor of The Southern Farm and Home that multitudes of examples in Northern and Middle Georgia have demonstrated that clover can be grown there with large profit, and that lucerne, grasses of various kinds, beets, turnips, &c., in fine everything necessary for dairy feeding, can be produced with certainty and with remunerative results.

THE WOOLS OF THE UNITED STATES.

Few of our growers of wool are thoroughly informed as to the specific uses of the various wools of different breeds and their various grades. It is the purpose of this investigation to describe the wools of the United States from the stand-point of the manufacturer rather than from that of the grower. A precise knowledge of the peculiar requirements of each branch of the woolen manufacture for the kinds of wool needed for any particular fabric, is not only an interesting department of technical knowledge, but one inuring directly to the pecuniary advantage of the wool-producer. It is also important to manufacturers that such knowledge should be possessed by those upon whom they are dependent for wool supplies. It is to this lack of intimate acquaintance with the peculiar wants of the various branches of the manufacture, rather than to climatic or other impossibilities, that the wants of the mill-owners are not more completely met.

DEPENDENCE OF MANUFACTURE UPON DOMESTIC WOOL.

Nine out of ten of the wool manufacturers of the United States, if asked the question, "What is the most pressing necessity of your manufacture?" would answer, "We want more domestic wool." The enlightened governments of all manufacturing nations have seen that the supply of domestic wool is the first and chief dependence of their manufacture. Seeing this, scarcely a hundred years ago the ruling sovereigns of Western Europe, by introducing merino sheep into their respective countries, did more to immortalize themselves than by any feats of arms. The King of Saxony introduced merinos from Spain into his kingdom in 1776, and Frederick the Second, about the same time, introduced them into Prussia. Merinos were domesticated in Hungary by the great Maria Theresa, and in France by Louis XVI, in 1786, and with what results? The influence of the Saxony breed is seen in all fine German broadcloths. In Prussia 18 per cent. of her exports are merino woolen goods. Hungary furnishes the supply of the raw material for the unequaled fabrics of Austria. The soft and fine merino dress-goods of France are in use all over the civilized world.

In the United States domestic wool is the very foundation of the wool manufacture. Very careful statistics, collected in 1864, show that, of all the scoured wool used in the woolen mills of the United States, over 70 per cent. was of home growth. Of 4,073 sets, 2,171 were employed wholly upon American wool. Of 931 mills, 767 used domestic wool principally, while only 46 mills in the whole country used foreign wool alone. No foreign wool was used in the Western States. As the number of mills

at the West has greatly increased, while the use of foreign wool in them is still unknown, the proportion of domestic over foreign wool used in all our mills has, without question, greatly increased. The new mills which have sprung up at the West and in the interior will obviously use domestic fleece, on account of the saving of transportation, the facility of selection and purchasing, and the opportunities for effecting saving to both manufacturer and wool-grower, in the exchange of cloth for wool. But there are general reasons which lead all manufacturers who can use American wools to prefer them. Our machinery is adapted to the working of our own wools, and our best skill, founded on an experience of their distinctive characters, is exercised in manipulating them. Although we may import limited supplies of foreign wool, an ample domestic supply would regulate the cost of imported raw material. As a result of the economic law, that no nation does nor can safely continue to import more than one-tenth of all it consumes, we cannot afford to import and pay for all the raw material which our machinery is capable of working up. If the domestic supply of wool is permanently curtailed we must inevitably curtail our manufacture, and the whole country will suffer from a less abundant provision of comfortable clothing for the great mass of our people. The failure, therefore, of a domestic supply of wool would be as fatal to our mills as the drying up of the streams of water which move them. It is from a practical conviction of this fact that the most intelligent American wool manufacturers and their powerful representative body, the National Association of Wool Manufacturers, are the firmest advocates of adequate customs duties upon domestic wools, as well as upon manufactured goods. The manufacturers bear willingly the very heavy burden of the greatly increased capital required by the higher cost temporarily imposed by the increase of the wool duties, from two motives: first, from the conviction that wool production is just as much an American industry as cloth production, and is entitled to equal defense against foreign competition; secondly, they appear to be profoundly impressed with the patriotic sentiment of Lord Bacon, among the wisest of our English fathers, "Let us advance the native commodities of our own kingdom, and employ our own countrymen before strangers." They would also adopt as a special injunction the other words of Lord Bacon, "Let us turn the wools of the land into cloths and stuffs of our own growth." There is reason to believe that, if the present scale of duties shall be maintained, there will be no limit to the manufacture of domestic wool, except that of its production. The president of the Manufacturers' Association thus presented his views at Syracuse in December last:

> The theory of protection requires time to test it, especially as to its effects on production; and the results of the theory which we advocate, and which we are putting into practice, will be fully manifested in its effects on the extension of wool culture. For myself, I have no doubt that, if another six years should elapse before the meeting of the next convention, when we come together we shall find that the consumption of American wool, now about one hundred and twenty-five million pounds, will aggregate more than three hundred millions annually. Of that I have no question under our present system. The demand will exhaust the supply, for there need be no check to the growth of wool in the United States, or to its extension over parts where no attention is now paid to sheep husbandry.

The preference of our manufacturers for domestic wools is founded upon a recognition of their good qualities. When we speak of American wools, we refer to the predominant class, wool from the grades of the merino, with the native or the degenerated English breeds, characterized by a greater or less predominance of the merino blood. There are certain qualities, common to the varying breeds, which are due to the influence of our climate and soil, but especially to the system of

keeping, consequent upon the thrifty habits of our people; and the most influential feature in their keeping is the fact that our sheep are uniformly and liberally fed, and hence produce a uniform, sound, and healthy fiber. Thus, the most characteristic qualities of American wools are due to the moral and economical habits of our people. There are other special qualities due to the blood at present predominant, that of the so-called American merino. As to the qualities of the full blood and grade merino wools of the country, the executive committee of the National Association of Wool Manufacturers, consisting of the most experienced and successful manufacturers of the United States, in a public report made in 1866, say:

In a class of fabrics entering more largely, perhaps, than any others into general consumption, that of flannels, the superiority, due principally to the adaptation of the common wools of this country, their strength and admirable qualities, is so marked as almost to exclude the foreign flannels. American fancy cassimeres compare favorably in finish, fineness, and strength with those imported. Our delaines, owing again in a great measure to the excellence of our merino combing-wool, surpass the fabrics of Bradford, at the same price. The excellence of American shawls was admitted at the Great Exhibition at London.

And they subsequently add:

It has been the experience of all nations that the domestic supply has been the first and always the chief dependence of its manufactures, and the peculiar character of the material has impressed itself upon the fabric which each country has produced. Thus, in the fine wools of Saxony and Silesia we have the source of German broadcloths; in the combing-wools of England, the worsteds of Bradford; and in the long merino wools of France, the origin of the flannels and cassimeres. The peculiar excellencies of merino wools have given origin to our flannels, our cassimeres, our shawls, and delaines; and they give soundness and strength to all the fabrics into which they enter.

SPECIFIC WOOLS ENTERING INTO AMERICAN FABRICS.

Common flannels involve a very important consumption of wools, from the coarsest common or native to medium merino wools; opera flannels, from fine to the very finest wools; blankets, from the most ordinary Mexican to noils, (the shorter or refuse fibers obtained by the process of combing the best combing-wools,) up to medium merino wools; also the shorter wools of English blood, such as the Down and Cheviot wools. Shawls, the principal varieties, embrace all grades of merino wool up to pick-lock, some fleecy varieties being composed of worsted combing-wools; felts, generally the lowest grades of wool, but some varieties of felting, such as piano and table covers, medium merino wools. Knit goods, such as knit-shirts, vests, skirts, drawers, cardigans, hose, involve a very important consumption of wool, from the lowest to high grades of merino, certain fancy varieties, composed of worsted yarns, requiring English combing-wools. Fancy cassimeres, occupying a prominent place in the list of fabrics, require all grades of merino wool, principally the medium; meltons, all grades of merino wool, without burr, principally medium; overcoatings, such as beavers, moscows, esquimaux, medium to finest grades of merino wool. For all mixtures of wool with shoddy, the best and longest merino wools are now regarded as most profitable, for the reason that they "carry" more of the short fiber of the wool substitute. Thin wool coatings require from medium to the finest merino wools; fancy ladies' cloakings, the finest long merino wools, and, in some varieties, mohair, or the wool of the Angora goat; gentlemen's worsted coatings, the finest long merino combing-wools. For certain varieties of delaines, coburgs, and cashmeres, ladies' dress-goods, with cotton warp, medium long merino wools are used; for Caledonian ladies' cloakings, a limited use is made of mixtures of fine long combing-wools and English or Canada combing-wools; for serges, moreens,

alpacas, Italian cloth for linings, mohair lusters, lastings, damask for furniture, for furniture covering, curtains and table-cloths, reps for furniture and curtains, webbing for reins and girths for horses and for suspenders, bunting for flags, military-sashes, picture-cords and tassels, clouds or nubias, ristori shawls, braids and bindings, all use long English combing or Canada wool; for the warps of ingrain two and three ply carpets, the long carpet-wools of Cordova and Chili, unsuited by their coarseness and unequal diameter for dress-goods, are employed, the short wools for filling, and, for the cheaper carpets, the short and coarse Mexican and Texan wools; for Brussels and tapestry, and Brussels and velvet carpets, the long Cordova and Chili carpet-wools are used, for the colored yarns the warp being of linen; for the whites or very light shades the best English or Canada combing wools.

The above list would seem to answer the question proposed for the next topic of inquiry: What kinds of wool shall be grown in the United States?

1. *Merino wools.*—This question, which is more often addressed to the manufacturer than any other by the wool-growers, can be answered much less definitely than might at first appear. If a majority of the cloth manufacturers in the United States were asked this question today, they would answer, "Give us the wool produced by a cross of the full-blooded merino with a full-blooded South Down," which would be a typical medium wool. A larger supply of wools of that class is in demand than of any other just at this time; but the production of such wools would be impracticable as a system in our ordinary methods of sheep-husbandry. The manufacturers of classes of dress goods into which delaine wools enter, have the same views. Mr. Walworth, the intelligent buyer of wools for the Pacific Mills, who is an authority, says:

The wool-growers of this country have run too much into the same quality of wool, viz., about three-fourths blood. Now, there is a certain amount of this quality of wool needed, but the markets have been flooded with this one kind, while medium or one-half blood and one-fourth blood wools are absolutely scarce. * * There is a great demand for medium or one-half blood wools, and I think it will be a permanent demand.

Still, he adds the very sensible advice:

Let the farmers grow a greater variety of wools, and not all just about the same quality.

On the other hand, the manufacturers of opera flannels and doe skins complain that they cannot get in the country any stocks of the superfine wools of Saxon blood, the type of which was the old wool of Washington County, Pennsylvania. They cannot get them, simply because they cannot afford to pay the high prices necessary to encourage the culture of these small-sized and comparatively unproductive sheep. It is absurd to say that the finest wools cannot be grown in this country, especially in Virginia and East Tennessee. Mr. William Chamberlain, in a letter dated March 21, 1870, says, that those who assert that superfine wools cannot be grown in the United States are mistaken.

There are some grown fit for the manufacture of the very finest goods, and there would be much more if we had a market at remunerative prices. I have, within the last fifteen years, imported nearly five hundred Silesian sheep, of the best quality, and have bred them ever since, and they continue to do well, as well as any breed of sheep that I am acquainted with. My shepherd, who has the care of them, is a Silesian, an experienced shepherd, and a man of perfect integrity. He had the care of one of the most celebrated flocks in Germany, and assures me that wool does not deteriorate in this country, and he knows no better country for the growth of fine wool. My flock averages fully eight pounds of unwashed wool. I have sold it for the last two years to one manufacturer in Connecticut. He has made what are called doe skins, and good judges assure me that the cloth compares favorably with the best German doe skins. * * The cross of the original Saxon and Silesian has resulted very satisfac-

torily, and has been used in Saxony extensively for a number of years; and it is found that the quantity of wool is increased without prejudice to quality. Fine wool can be grown in all parts of our country where the soil is dry, but in the South the fleeces become less dense, and of course lighter; on the sea-coast it gradually becomes coarser. You may be fully assured that our country is a good place to grow fine wool. All we want is a decent market, and manufacturers can be supplied without importing it from Australia and Germany.

While cultivators, with means to encounter temporary depression of prices, through perseverance in the culture of a perfected race will ultimately be rewarded by winning appreciative customers, it is vain to expect American wool-growers, except in rare cases, to pursue the culture of fine wool here when it is rapidly disappearing even in the countries which originated it. The observations of Mr. Moll, chairman of the jury on wools, at the Paris Exposition, are pertinent on this subject. He says:

The *superfine* wools, like the fine wools, are produced from animals of the Spanish race; but the race has been so completely transformed by art (selection, prolonged stabulation, and special feeding) that they can no longer acclimate themselves in the country where they originated, or, at least, accommodate themselves to the keep to which the original flocks were submitted. These wools measure from one fourth to one-eighth centime of a millimeter in diameter. Their length rarely surpasses four centimeters. They serve for the fabrication of the most precious of the woolen fabrics, imitation cashmere shawls, merinoes, and extra-fine cloths, mixed tissues of wool, silk, &c.

Commerce holds these wools in the highest estimation; but as the improved machines and processes enable us now to make from wools of lower quality stuffs having as handsome an appearance, those wools cannot secure a price proportionate to the expenses of their production, which are very great, in consequence of the care which the animals require, and the small weight of their fleeces. *This branch of industry is diminishing rather than augmenting.* Many of the superfine flocks in France have disappeared. Saxony, the cradle of this race, which has received the name of Electoral or Saxon, has now almost none. Silesia alone still possesses a certain number, which, with the flock of Naz, and some others, disseminated in Bohemia, Moravia, Hungary, Prussia, and Poland, furnishes the whole of the superfine wools used in Europe.

As to the superfine merinos, the Electoral type, or that of Naz, it is evident that they can be kept only with a view to the production of wool alone, for of all the ovine races there is, perhaps, none which has less aptitude for fattening, and every time that the attempt has been made to increase their corpulence it has produced an alteration in the wool. It is true that this wool is of greater value than any other, but this advantage is more than counterbalanced by the small weight of the fleeces and the more minute care which these animals demand. Shall we ever succeed in making a race suitable for the butcher, and at the same time preserve the fineness of the wool? It is doubtful. It is desirable, however, that Europe should preserve a certain number of flocks of the fine type, if only for raising reproducing animals, to renovate the blood and preserve a certain fineness which threatens to disappear.

Mr. Moll concludes his references to this race by briefly mentioning the requisites of soil and climate for their culture:

They must have other physical conditions than those which suit the mutton-sheep; a climate dry and warm, a land with light, permeable soil, and rather poor than rich, and a nourishment rather tonic than substantial.

Mr. Sanson, the most eminent of recent French writers upon the zootechny of sheep, observes that—

It is evident that in the greater number of the agricultural situations upon the European continent, the production of short wools cannot be economically pursued, as they are fitted only for the pastoral system, which is every day losing its importance in favor of the intensive culture.

Mr. William Latham, a very intelligent English flock-master of Buenos Ayres, in a work devoted to suggestions for the improvement of the wools of that country, rejects "the exquisite Prussian Silesian merino" as unsuited to that country for general purposes. "Destroy its purity of blood, *mestize* it," he says, "and you have relatively nothing. Only under the highest degree of breeding, intelligence, and minute care could such a breed maintain its way." He regards with but little favor,

too, the Saxon Electoral Negretti, "although beautifully true in shape, fine and soft wool, with a fair weight of wool in the higher strain of blood. Their habits and characteristics," he continues, "are the result of special treatment and selection; a high artificial temperature, treatment, and stimulation of the skin, increasing the skin-growth, and producing the numerous rolls or folds which cover the whole body, and creating the habit of excessive exudation of oleaginous matter, superinducing a diminution of the carcass, and loss of corporeal vigor, all of which render them and their progeny ill-adapted to harmonize with conditions essentially different from those which produced these specialties. Exposure of their progeny to inferior conditions of maintenance necessarily increases the tendency towards diminution, and causes an actual diminution of the carcass; the wool, though retaining the fineness, becomes short and weak in staple, and the fleeces open and light."

Before dismissing the subject of superfine wools, we would remind the readers of the Agricultural Reports of a remarkable article by Mr. C. L. Fleischmann, in the report of 1847, which attracted much deserved attention when it appeared. It will be remembered that this account contains a most minute description of the laborious and expensive system of the superfine sheep-husbandry in Prussia, then at its highest prosperity, which quite disheartened the American growers of Saxony sheep. The very extensive collection of wools illustrative of this report was deposited by Mr. Fleischmann in the collections of the American Institute of New York. At the time of the exposition of woolens at the fair of the institute in 1869, we had the pleasure of seeing this collection, and the gratification of observing that it was in excellent order. With our present ideas of wool staple, it appears almost inconceivable that these wools could have been a staple, agricultural product. The length in no case exceeded an inch, and was often considerably less. The fleeces were represented as weighing from 1½ to 2½ pounds, and the fiber was marked by the distinctness and number of its curves or wrinkles, the curves being so sharply defined as to give the impression that they had been artificially crimped. It would be a graceful courtesy on the part of the American Institute to transfer this invaluable collection, which cannot be replaced, to the vigilant care of the curator of the National Museum in the Department of Agriculture.

While the demand for medium wools for some years to come is likely to be the most pressing, the remunerative demand for the very fine wools last spoken of will probably even diminish. There is likely to be an increased demand for a class of merino wools, which Mr. Sanson, the scientific writer on sheep before referred to, calls intermediary wools, quite different from our medium wools. He observes that "between the common and fine wools, or more exactly between the fine and superfine wools, a new quality has been introduced within a few years, which is of great interest in France." This new quality is that of the intermediary wools, differing from the fine in reality less in their diameter than in their length. This wool is not only very important for clothing purposes, as the improvements in power-loom weaving necessitate the use of this long wool for warps, but for combing purposes, and especially for a class of goods known as novelties. Clothing manufacturers in this country have but recently appreciated the qualities of these intermediary wools, for to this class belong principally the Australian and New Zealand or Tasmanian wools, heretofore almost unknown, but which have been very largely imported by our manufacturers during the last year, notwithstanding the high duties. The fineness, length, soundness of staple, and remarkable freedom from grease have brought them into

deserved favor. Manufacturers have thus a new standard of excellence in wools, and American wools having the qualities of this standard cannot fail to be in demand.

The method of reaching by amelioration of our present flocks this new standard is a question of much practical interest to our wool-growers. That they may have a view of the means by which such a result has been attained elsewhere, we will refer to methods advised by Mr. Latham, before quoted, for ameliorating the flocks of Buenos Ayres. Mr. Latham regards the Australian type as the model for imitation in the present demands of the wool manufacture, and believes that the means to reach that standard is the persistent use of rams of such special type of the merino family as will most effectually produce the desired improvement. The race for which Mr. Latham avows his unqualified preference for the purpose of amelioration is the pure French merino, of which the best type proceeds from the Cabaña Imperial or the sheep-fold of Rambouillet. The view of Mr. Latham, that the flocks of Australia have been improved by the French merino, is abundantly confirmed by other authorities. He says:

I believe that it is to this blood of Rambouillet French merino, and George III merino, that we must look for the regeneration of our flocks. I am confirmed in this opinion by observation here, by the knowledge of the want of the great manufacturing interest in Europe, and by the practice of Australian breeders. * * The beautiful little Negretti, with its fine, soft, fleece, may be a more attractive object, but it cannot fulfill the requirements of our flocks so well as the solid Rambouillet and English merino, from whose progeny, in a few crosses only, a size of carcass, a thinness of shape, a weight of fleece, length, fineness, and texture of wool can be obtained (as I can testify from actual observation) equal, if not superior, under proper management, to nine-tenths of the sheep of the French merino Cabañas.

The distinctive characteristics of the Rambouillet variety of merino are those of considerably larger carcass, (two-year old rams, of the acclimated race of this breed in the author's own flocks, having attained weights of 200 and 250 pounds,) longer wool, weightier fleece, fewer skin-folds, and better fattening qualities than the German varieties admit of. These are results obtained by a course of treatment conducive to corporeal vigor and healthfulness, which will render them better reproducers, and better calculated to meet, without prejudice, changed conditions, and better adapted to enter into harmony with them, and to receive the healthful modifications which local influences impose under a system consistent with them.

In the treatment under which the French merino types have been formed, there is less stimulation of the skin, less exudation of oleaginous matter; hence a large amount of the food taken is assimilated into the substance of the body and the wool, while the fullness of the carcass, brightness of look, vigor of carriage, greater length, brightness, strength, and the less greasy or heavy condition of the wool, may be contrasted with the shrunken habit of carcass, dull, anxious look, and wool overcharged with grease, which the German merinos exhibit. It is also noticeable that the Rambouillets, from their more vigorous and healthy habit and absence of excessive stimulation of the skin, are less subject to the "scab" and other cutaneous diseases, less liable to lung affections, the rams less exposed to constitutional "breakdown" in course of "service," and the wool, being longer, stronger, and less greasy, is not so likely to collect impurities, and suffer prejudice from burs, grass-seeds, &c.

We ought not to omit the testimony of the more intimate observers of this race of sheep in their own country. Mr. Moll, in his capacity of chairman of the jury on wool at the Paris Exposition, and with specimens of all the wools of the world before him, observes:

While Germany has had regard only to fineness, our skillful cultivators in the region of Paris have occupied themselves more with the quantity, and have not neglected the question of meats. They have modified the race, and have given it, by means of an intelligent selection, suitable nourishment and care, more size, forms better suited to fattening, and, above all, to a more abundant fleece; and to a wool, not so fine indeed as that of Germany, but one which, in consequence of improvements in machines and processes, responds much better to all requirements, and which, thanks to its length, strength, and elasticity, is suited equally to the card or the comber.

The imperial sheep-fold of Rambouillet has mostly contributed to this happy movement, of which it has taken the initiative, and in some sort the direction. We may say that the Rambouillet type is at present, in an economical point of view, and for

the rich countries of the vine-bearing zone, the most perfect type in existence of fine-wooled sheep.

The qualification as to region, in the last paragraph, suggests that this race would be more likely to flourish in southern than in northern sections of this country.

In making these citations, and the suggestions founded upon them, which are addressed less to the mere wool-growers, whose main object is the rearing of sheep for the different purposes of wool-growing and meat-production, than to the class which combine with sheep-growing the higher object of introducing to this country the best and most suitable blood that the world can produce, and who aim, with this blood, to create for their country a superior race, it is very far from our purpose to suggest a general modification in the qualities of the characteristics of American fleece. The great mass of these American wools suits our machinery and prevailing fabrics. The demand for the intermediary wools is as yet comparatively limited, but will increase with the expansion of our fine merino combing-wool manufacture, which, for the production of all wool dress-goods, did not exist four years ago, but is now successfully inaugurated, as the adaptation of these wools for both clothing and combing purposes is better appreciated. As these wools are in so high demand in Europe, the demand must become more extensive here.

With regard to the French merinoes as a source from which to infuse new blood into certain of our flocks, we are aware that the greater number of those introduced into the country a few years ago were regarded with but little favor, as they were selected solely with reference to their excessive size, without regard to other characteristics; their superior keeping and unusual care, while at that time there was no demand for their peculiar qualities of fiber. Dr. Randall observes that, "The stock imported in 1840 from the royal flock at Rambouillet was not overgrown. Their size, however, exceeding that of the American merino, was an entire novelty, and a most captivating one to the public eye." With the new demand for long and fine intermediary fleeces, the introduction of these regenerators, which have proved so efficient in Australia and Buenos Ayres, might well be again essayed; and if refinement is to be attempted with this blood, that stock might furnish a better foundation for refining than the vigorous and productive American merinoes, which, with all their excellencies, are still lacking in the fineness of fiber and exemption from excessive grease which characterize the French and Australian standards.

The practical importance of the subject warrants a few words upon the much-discussed subject of excessive yolk or grease in fleeces. It is well known that the tendency of American wool-growers to produce heavy fleeces is a subject of much complaint with manufacturers. The first object with the manufacturer, provided he can have other requisite qualities, is to have clean, light wool. The yolk, which causes the principal portion of shrinkage in scouring, is of hardly any value in the present methods of washing. Where unwashed wools are exported, the removal of the yolk by climatic influences sometimes adds very materially to the value to the manufacturer of the whole clip in certain seasons. Thus the prevalence of great rains over an extended region in Australia, where there is no provision for shelter, just before the annual shearing, has, sometimes, by washing out the yolk, made the whole wool-clip of that season exceptionally valuable. It is argued by breeders of authority that, to produce the greatest amount of clean wool with the greatest economy to the wool-grower, he must also produce a certain proportion of oil; that up to a given point the increase of wool may be measured by

the increase of oil; that it is not just to charge upon the wool-growing community that they produce uselessly heavy fleeces, while they can demonstrate that their growth of clean wool is increased by a proper attention to grease and yolk, and that the quality of the wool may be increased by this attention; that if the grower has a flock of light-shearing sheep and desires to increase the clip of his future flock, he can accomplish this object only by the use of a greasy ram; and that this is owing, not to the grease alone, but to the fact that with a proper secretion of oil and yolk, there are usually found those other points which make a ram valuable, such as firmness and thickness of fleece, uniformity of style over the whole surface, and that most attractive feature of a good sheep, a well-wooled head, with a clean, strong, and expressive face.

On the other hand, writers of equal experience express the opinion that no species of merino ram ever produced more than twenty pounds gross weight of fleece without excessive feeding or unnecessary housing, and that it is advisable to raise such sheep as can be raised without such treatment. Certainly the freedom of the fleeces of the French merino from excessive exudation of their yolk, with their magnificent development both of carcass and of wool, a fact noticed not only by Mr. Latham but by all the French writers, is an indication that the best development of flesh and fiber is not necessarily connected with undue protection of yolk. An infusion of the blood of this race may perhaps tend to the improvement so much desired by manufacturers.

It should be noted that Dr. Randall, the highest authority on American sheep-husbandry, denounces with great severity the breeding for yolk, although maintaining that the American merinoes, when bred and treated judiciously, do not produce more yolk than is necessary for the economical production of wool, and declaring that there is no other national family of merino, and no other breed of sheep whatever, that can vie with the American family in the very great improvement in weight of washed or scoured fleeces within the last few years. In the exhaustive monograph on the American merinoes, published as an appendix of the report on wool and woolens in the report of the Paris Exposition, he speaks as follows:

This remarkable era in merino-breeding, commencing in sound measures of improvement, but culminating during the war in the excess which I have described, developed several fashions in breeding and management, which were altogether new in the business. Quality of wool was little talked about. Weight of fleece was the primary consideration, and it became the custom of many breeders to weigh their fleeces in the yolk, because, I suppose, it gave them an advantage over others. A rigid system of housing their sheep from contact with rain or snow the year round would preserve all the yolk in the fleece, and thus would add to its weight several pounds. The holders of the larger flocks could not do this without great inconvenience and expense. The former, therefore, were enabled to go into newspapers with far higher statements of weights of fleeces. Inasmuch as the system of housing and preserving all the yolk in the wool gave the fleece externally a very dark color, the color soon became a prime necessity of fashion, and, as the weight increased, and the color became darker with the yolk, the latter was as carefully bred for as wool. I have seen it literally dropping from the fleece under a hot sun. As a high-fed sheep produces considerably more wool and yolk than an ordinarily kept one, a system of pampering was also extensively resorted to. Many of the summer and winter-housed flocks were fed grain to the utmost verge of immediate safety, and far beyond the bounds of ultimate safety; for such continued forcing is destructive to the constitution and longevity of merino sheep, as all will bear witness who have tried or observed its effects.

Under the above system of breeding and treatment, and sometimes without any special pampering, merino rams' fleeces in the yolk are frequently reported as weighing upward of 25 pounds, and some have risen to 30 pounds. Ewes' fleeces range from 10 to 15 pounds, and sometimes individual or small lots have gone higher. Unfortunately these weights afford scarcely an approximate criterion of the actual weight of the wool, the proportion of yolk to the wool possessing no uniformity.

The practice of housing sheep from rain and snow for the preceding objects is not a

fraud, if distinctly avowed to all buyers. But I think it is productive of no benefit, and of considerable injury. It is a useless waste of a great deal of time, and occasionally produces loss in other respects. The new-mown hay or grain must be left to get wet on the ground, to the serious deterioration of its quality, rather than have the precious weight-giving and color-giving yolk washed out of the fleece. And there can, it appears to me, be no reasonable doubt that this habitual non-exposure to the ordinary changes of weather must, in the course of time, to a greater or less degree, beget an incapacity to endure such exposures with entire impunity. Besides, this housing, if ever so frankly proclaimed, tends to warp the judgment of all buyers, and especially inexperienced buyers. If it did not give a fictitious value to the animal—rendering it more salable than sheep of equal value not thus treated—where would be the use of it? It is perfectly notorious that it, with early shearing, does so alter the appearance of the sheep, that a pair of twins of the closest resemblance, one thus treated and the other not, scarcely look as if they belonged to the same variety, and the "petted" one will far outsell the other. It is considered the breeder's right, in all kinds of domestic stock, "to put the best foot forward," and it is equally done with other breeds of sheep; but it is a pity that a higher standard of action cannot be permitted to prevail. Such fashions beget inducements to direct fraud. Thousands of *painted* sheep (painted to the true color by a preparation of oil, burnt umber, and a little lampblack) are annually hawked about the country with pedigrees as artificial as their color, and sold as genuine Simon Pures.

Fitting sheep for sale by pampering is fraudulent, for it is never avowed or admitted, and if it were, there can be no honest or decent excuse for a practice which is directly and undeniably fatal to the well-being of the animal. We have no right to poison what we sell, because we know there will be fools to buy it, and to buy it more readily because it is poisoned. Another result has followed this indiscriminate scramble for large fleeces. Those who have carried it farthest have usually considerably depreciated the quality of the wool. The finest fleeces are not generally the heaviest. The greatest combination of wool and yolk—however coarse, uneven, and even hairy, the former—is what these extremists have looked for in their breeding-rams; and the progeny of such rams must, of course, partake of the same characteristics.

2. *Combing-wools.*—The distinction between these wools and the card or cloth wools, before treated of, may be thus stated. Combing-wools are those specially fitted for the process of combing by hand or machinery, which process consists in drawing out the fibers so that they may be straight and parallel; the shorter portions, called "noils," being removed by this operation. The fibers having been rendered straight and parallel are twisted or spun, and the yarn is called worsted. The ends of the fiber being covered by the process of spinning, the yarns are smooth and lustrous.

Card or cloth wool is wool fitted for being carded. By this process the fibers are placed in every possible direction in relation to each other, adhering by the serratures of the fiber, which are more numerous in the wool adapted to carding. They are thus fitted for felting, and the ends of the fiber are free to be drawn out into the nap. While card-wools are required to be fine, or comparatively so, short in staple, and for the hightest fabrics full of spiral curls and serratures—qualities possessed by the wool of which the merino and Saxony fleeces are types—the combing-wools, on the contrary, must be long in staple, from four to seven inches, comparatively coarse, having few spiral curls and serratures, and possessing a distinct luster. These qualities are possessed in perfection by the English sheep of the Lincolnshire, Leicester, and Cotswold races; and in a less degree by the Cordova wools of the Argentine Republic and the Donskoi wool of Russia. Comparatively long, fine wools of the merino race, from two and a half to three inches in length, are combed for making coburgs, merinos, and similar fabrics, but they are not classed in the trade as combing or worsted wools.

An unprecedented demand for these wools has arisen in all manufacturing nations within the last ten or fifteen years, and the prices have more than doubled within that period. This is due, first, to the vast improvements in machinery for combing made within that period; and, secondly, to the late scarcity of cotton, and to the discovery that

by the use of these wools with cotton warps, an admirable substitute is found for fabrics formerly made from the fiber of the alpaca.

Some of the fabrics made from combing-wool have been already mentioned. The list could be greatly extended, as these wools compose the principal portion of the wool or part-wool fabrics for female wear, the consumption of which is constantly increasing. The contexture and patterns of the fabrics, or their combinations with silk, cotton, mohair, merino-wool, and China-grass, are perpetually and almost indefinitely changed to suit the caprices of fashion. Not only new tissues but new names appear each year, to conform to the fickleness of female fancy. A hundred different tissues, not styles, are made by a single house in Bradford. But the basis of all the fabrics remains the same—English combing-wool.

The magnitude of this manufacture, and our present dependence upon foreign nations, are shown by the following statistics: Great Britain had, in 1871, 630 worsted-mills, with 35,746 power-looms, employing directly 109,557 operatives; while she had 1,829 woolen-mills running 34,146 power-looms, employing 125,130 operatives, the worsted manufacture employing only 14,573 less persons than the woolen manufacture. Our importations of dress-goods—composed principally of combing-wool—for

1869—63,278,264 yards, of declared value of	$15,463,942
1870—67,490,126 yards, of declared value of	16,552,393

Our importations for cloths, for a corresponding period, were, for

1869—Of a declared value of	$7,688,343
1870—Of a declared value of	9,543,911

Worsted yarns of the finer grades were made in this country only to a very limited extent prior to 1860 or 1861, except those made of shorter wool delaines, the yarns manufactured prior to that date being principally designed for carpets. The introduction of the finer worsted yarns was due to our command of the Canada wools of English blood, which were admitted free under the reciprocity treaty. In 1866 an estimate submitted to the revenue commission placed the capital employed in the manufacture of yarns and the varied kinds of worsted goods, exclusive of the manufacture of delaines, in which American merino wools are used with shorter Canada wools, at $8,000,000, and the yearly value of the product of worsted goods at not less than $10,000,000.

It was remarked in 1869 by Mr. Mudge, the commissioner for wool and woolens at the Paris Exposition in 1867, that—

> At the time of that Exposition we had not then perfected any one single article of all-wool worsted fabrics in this country (not referring to mixed fabrics) which was worthy of being represented there, or, in fact, in any exposition. It is a source of pride and pleasure to all Americans to consider that, in so short a space of time, so much has been done. If you look at the exhibition of worsted fabrics at the Fair of the American Institute in New York you will see there a variety of worsted fabrics of which you need not be ashamed.

Mr. Mudge spoke modestly, for he was the pioneer in a field in which he has achieved brilliant success. And we add that all the money expended by the Government of the United States, on account of the Paris Exposition, will be a hundred-fold repaid by the new arts, not fabrics, which that patriotic commissioner imported into his own country from Europe.

Some comments upon the exposition of woolen goods at the fair of the American Institute in 1869, made by Mr. John L. Hayes, Secretary of the Manufacturer's Association, express more fully the progress made in the worsted industry:

During the gloomiest days of the war an association was formed in Washington of patriotic ladies, who pledged themselves to wear nothing except of American fabrication, and we were witnesses to the chagrin with which they discovered the extremely limited variety of worsted goods manufactured here. How much would they have been relieved if they could have seen such a display of worsted goods as was exhibited at our Exposition? Besides the beautiful delaines and coburgs of the older manufacture—the fabrics originated since the war—the worsted plaid poplins, the Caledonian cloakings, serges, printed cashmeres, alpaca and mohair lusters, mohair poplins of all shades, tissues not simply noticeable for being new, but for intrinsic excellencies, enable us to supplant foreign productions. * * Five years ago all our furniture and curtain stuffs, under the general term damasks, were imported. * * Two alcoves displaying draperies of all-wool and common damasks, silk cotelines, reps, and terrys of various, though chaste, designs and colors, illustrate the advantages which the American consumer has in depending upon home manufacturers who will not insult their taste by the glaring designs usually produced for our market.

To the above enumeration might have been added the important fabrics, buntings and lastings, achieved since the war.

This enumeration should convince wool-growers how earnestly the worsted manufacturers are looking to them to supply the combing-wools, whose deficiency is the only impediment, under a stable system of protection, to an indefinite expansion of the worsted industry. In 1865 the worsted manufacturers were most solicitous for a renewal of the reciprocity treaty, under which they obtained the Canada combing-wools free of duty. In 1866 they entered into arrangements with the wool-growers which led to the tariff of 1867, and imposed a duty upon Canada combing-wools, practically amounting to 12 cents per pound and 10 per cent. *ad valorem*, and placed corresponding duties on worsted goods. In 1868 active efforts were made by the Boston Board of Trade and other commercial bodies for a renewal of the reciprocity-treaty, while the inducement of free Canada combing-wools was urged upon the manufacturers as a motive for joining the movement. The manufacturers refused the bait so temptingly offered, and in October, 1868, the Manufacturers' Association, at its annual meeting, all the principal representatives of the worsted industry being present, unanimously passed the resolution—

That any advantage which might accrue to worsted manufacture from the free introduction of combing-wools under the proposed reciprocity treaty with Canada would be more than counterbalanced by checking the impulse which has already been given to the growth of combing-wools here; while the advocacy of the reciprocity treaty for the purpose of obtaining Canada wools free would be a violation of the spirit of the agreement with the wool-growers upon which the present tariff on wool and woolens was founded.

Here was a practical exhibition of faith in the protective policy, and of confidence in the enterprise and intelligence of the farmers, which it was believed would lead them to cultivate with vigor this new field for production which the national legislature had opened.

It will be interesting to agricultural readers to know the individual views of some of the leaders in this department of the woolen industry, and we append some extracts from remarks made at one of the social reunions of the Manufacturers' Association, not only to show the importance attributed by these practical men to the growth of combing-wools, but to show how prudently, while dwelling upon this point, they deprecate the abandonment of other branches of wool production.

Mr. E. B. Bigelow, the first president of the Manufacturers' Association, and who, more than others, is entitled to the honor of the conception of the policy which has so happily united the wool-growers and wool-manufacturers, remarked as follows:

The combing-wool industry, and the coarse and fine grades of the card-wool industry, have been alluded to, and a question arises as to their relative importance at the present time. It is well known that the card-wool industry constitutes by far the

larger part, probably four-fifths of the whole; and of that the extreme fine grade forms only a small percentage. The combing-wool industry, as has been stated, has recently assumed considerable importance. The principal hinderance to the further rapid extension of this branch of manufacture is the limited supply of raw material. Clothing-wools, or card-wools, as they are sometimes called, are produced in superabundance the world over, while there is a deficiency of long combing-wools. There is nothing that would give such an impetus to the manufacture of worsted fabrics in this country as a full supply of home-grown long combing-wool. Could our farmers, especially on the Atlantic slope, near large towns, where their mutton would find ready sale, be induced to engage more extensively in the production of such wools, I am sure they would find it a source of immediate and permanent profit. It would also be a national benefit, not only by furnishing the raw material for an important branch of manufacture, but by supplying a much-needed article of food. It is the growing of the long combing-wool and its manufacture which have contributed so largely to the prosperity of England. The thirty millions of sheep which she supports are mainly such as produce this description of wool.

The value of the worsted manufacture in England, in 1857, was £18,000,000, (or $90,000,000.) Since that time it has largely increased. In 1864, besides supplying the wants of the people, she exported fabrics to the value of £16,000,000, (or $80,000,000.) In the town of Bradford alone, the worsted manufacture increased in value from £8,000,000 in 1863 to £13,000,000 in 1866. To France, as well as to England, the worsted manufacture is an important source of wealth. During my recent visit to Roubaix, I saw evidences of material prosperity, such as I had rarely seen before. Its population, then 76,000, had doubled during the preceding ten years—43,000 of them being employed directly or indirectly in the manufacture of worsted stuffs.

I have stated that the clothing-wools are produced in superabundance. I ought to have excepted the very fine wools, the production of which is rather decreasing than increasing in all wool-growing countries. One reason for this decrease is that it is less profitable to raise than the coarser grades; another is that the fashions and the times have changed. Instead of fine-wool fabrics many people now wear coarse-wool fabrics. Improvements in the processes of manufacture have enabled manufacturers to make from the coarser fiber certain fabrics which are as satisfactory to the consumer as the finer wool fabrics of former days. It is desirable that we should have a home supply of all the varieties and grades of wool required by our manufacturers, and I hope that our association will strive to bring about that result, and that in view of the growing demand and deficient supply of long combing-wool, it will make special effort to extend that branch of our sheep-husbandry.

Mr. Mudge, late commissioner, &c., said:

I can only say to the wool-growers and agriculturists of this country that there is a field more vast than their imagination can take in, in the expansion of the worsted industry. It is the great branch which has engaged the attention of the two greatest nations of Europe, France and England, during the last ten years. The great extension of their manufacturing industry has been in this branch of manufacture. * * I believe the agriculturists of our country should pay, not entire attention, but more attention to the growth of long and luster wools. There is a large amount of these wools now required for the use of the worsted machinery of this country, and we shall extend our manufactures in this branch, provided both wools and worsteds continue under the fostering care of the Government.

Mr. J. Wiley Edmands, the present president of the Manufacturers' Association, said:

The interests of wool-growers being intimately connected with ours, they are subject to all that befalls us as manufacturers. One difficulty we meet with is from the fickleness of the demand for goods from changes of fashion, and the different requirements of our customers as to the styles and characters of goods to be furnished to them. We have to meet the demand, and the changes required of us we must require of the wool-growers.

It is true that it is but a few years since we called on the wool-grower to furnish us the finest wools, because then the products from fine wools were in demand by our customers; but now all this has changed from the changes of fashion, and the present demand is largely for the coarser wool—for the staple that makes the Scotch tweed and other cloths that predominate in the fashions of the day. The fickleness of the demand is illustrated in my experience as a manufacturer of dress goods. It has been, until very recently, our aim to bring out our delaine fabrics so that they should be soft to handle, and in finish to imitate the all-wool French merinos. Now, as the fashion is, many styles of these goods must be made as stiff and hard as possible. We have to accommodate our fabrics to the changeable tastes of the ladies, and the consequence is we now require a large supply of the long, hard, combing-wools. At the present time it is the long, combing-wools that we want, and shall continue to want, for our

worsted goods. Coarse wools are in demand, too, for cloths for men's wear, but I doubt not that we shall very soon find the clothing-wool manufacturers calling for fine wool. Then the farmer will find encouragement to produce the best wools, but at present there is a surplus of fine wools grown in the world, and they command a low price compared with the coarser staple. I venture to say that it will not be three years before we shall find the fine wools of the country in demand again. At present long, combing-wools are in request, because the worsted goods have been lately introduced, and they are now the most remunerative of our fabrics. The combing-wools of this country are on the increase, and we are now beginning to receive them from Kentucky, and from Missouri and Oregon; and I doubt not that, with the present *stimulus*, their production will be abundant in a very few years.

This extract shows that it is not for the interest of American manufacturers, as a whole, to favor the production of any special class of wools.

There are some general considerations resulting from the history of prices, and the condition of wool production in the world, which we cannot pass by.

The first of these considerations is the relative prices which combing-wools have attained in the markets of the world. In 1855 the price of English combing-wool was 1*s*. 12*d*. In 1864 the price of the same wools was 2*s*. 4*d*. Cordova wools in 1855, 8¾*d*.; in 1864, 11½*d*. Australian fleeces averaged in 1855, 1*s*. 8*d*.; in 1864, 1*s*. 10*d*. Cape fleeces in 1855, 1*s*. 5*d*. in 1864, 1*s*. 4*d*. Buenos Ayres, fair mestizo, in 1855, 7*d*.; in 1864, 8*d*. Thus, while in nine years the combing fleeces had doubled in price, the fine wools had about held their own. The reason for this increased price of combing-wool is very plainly shown by the report of the Chamber of Commerce of Bradford, of 1869, which states that, while in 1861 1,289,172 spindles and 43,048 power-looms were employed in England in the production of worsted yarns and goods, 2,193,210 spindles and 71,666 power-looms were in active employment in 1868; and since then the ratio of increase in England, and in many places on the continent, is believed to have been still greater.

The successful production of combing-wools is limited to populous districts where there is a demand for mutton, and to countries where there is an improved agriculture. Thus, England and Ireland grow the most and best combing-wools, while a little is grown in France, Transylvania, Hungary, and Holland. England and France need all the combing-wool produced in Europe, and are already competing with us for the combing-wools of Canada, that country being the most important source of production on this continent. Thus, while the production of fine merino wools in this country is liable to be affected by the competition of the vast pastoral regions of the southern hemisphere, Australia, the Cape of Good Hope, and the boundless pampas of South America, and without protective duties would be certainly overwhelmed, there is no probability of overproduction in the growth of combing-wool, and protective duties on these wools are desirable, rather to stimulate production than to resist foreign competition.

The next practical question arising is, "Where in this country shall combing-wools be grown?" The president of the National Wool Growers' Association asserts that the Cotswolds and Leicesters are well adapted to profitable breeding for mutton and wool combined, in situations where the lands are rich, not subject to drought, and are adapted to root-culture, and where good city markets are easily accessible. "They are great favorites," he says, "with dairy farmers and with grain-growing farmers who wish to keep but few sheep."

Mr. Walworth, the practical wool-buyer, before referred to, after urging the superior profits of long-wool production, says:

Now, although it may be most profitable to keep combing-wooled sheep, it will not do

for every one to go into it indiscriminately. Men who wish to have large flocks of sheep, say several thousand, or even a thousand in a flock, ought not to keep these sheep, but will do better with the merino. Men living on the prairies ought not to keep them, for the prairies will not grow combing-wool, but I think they should in many parts of Kentucky, Ohio, the hills of Pennsylvania, and New York, and in the best parts of Michigan; and in particular I would suggest to those farmers who have now in many of the States coarse native sheep, whose wool is common, and does not yield much combing or delaine, that if they would cross those sheep with a Leicester or Cotswold ram—I like the Leicester best—in one year they would receive more than 50 per cent. for their outlay, for their sheep would be larger and would yield, probably, 20 per cent. more delaine or combing-wool, which sells for more and sells quicker. Let them follow this cross up for a few years, and they might, with a very little expense, improve the breed of all such sheep. I do not recommend them to buy very costly rams for common purposes. Let men who make breeding a business buy the fancy bucks.

I would not recommend the farmers in the far West, or in very new countries, to keep these sheep, for in such places the breed is apt to run out, and the wool becomes brushy and hairy, and of very little value. I think Michigan well adapted for delaine wools of the medium grades. In that branch I have always classed her next to Ohio.

Another question is, "What breeds of combing-wooled sheep shall be kept?" The editor of this report, in an address before the New York Agricultural Society, thus states the prevailing opinion among growers, and the *desiderata* as to further knowledge upon this subject:

The Cotswolds appear to have the preference of by far the larger portion of the mutton-producers, on account of size, hardiness, weight of fleece, and weight of fiber. For the production of early lambs upon native or grade stock, the South Down is the preference of three-fourths of the breeders, although the Cotswold is liked by many. The Leicester, the basis of English improvement, to which nearly all her improved breeds owe an infusion of their best blood, is too highly bred to escape deterioration under our careless practices. The Lincoln, as modified by the breeding of the last few years, is a magnificent animal, producing a lustrous combing-wool of great length; and it is hoped the breed may gain a firm foothold upon certain districts characterized by succulent and abundant pasturage and large yields of roots and grains. Much of the mutton stock of the country is so mixed and degenerate that an expert would be puzzled to tell what breed is predominant, and the opinions of the sheep-farmers as to the comparative merits of different breeds are consequently confused and erroneous. It is greatly to be desired that the efforts of honest and reliable importers and breeders of really fine animals should receive encouragement; that a better acquaintance with the best types of the breeds may become general, and a more complete test of their comparative merits for different locations may be generally enjoyed.

For the purposes of the worsted manufacture, the wool of all the English races above mentioned is desirable, even the fleece of the shorter-wooled Down sheep is well adapted for delaine tissues of the coarser texture at present in demand. The value of the Leicester race, for the production of a higher quality of long combing-wool, appears not to have been duly estimated in this country. Leicester wools, pronounced by experts to be equal to the best English, are produced in Ohio, on the borders of Lake Erie. The report of the Chamber of Commerce of Bradford on wool supply, issued for the purpose of instructing the British colonies and foreign dependencies in the production of worsted wools, is the most authoritative statement as to the most desirable race for the production of combing-wools. Speaking of the Canada wools, the report says: "The bulk of this wool appears to be a neglected Leicester, but it is capable of improvement. There is a tendency in some parts to cross the native sheep with United States merinoes, but for the English market we recommend new Leicester rams, so as to impart length, lustre, and soundness to staple." Speaking of the Turkish wools, it says: "Crossing with Leicester rams would much improve these wools for this market;" and, of the Wallachian, "Very suitable for the carpet trade; could be considerably improved if crossed with Leicester rams." Of the New Zealand wool: "Large supplies of this wool now come to the English market, and are very much in favor, especially the long-stapled wools, usually termed the Leicester breed,

which, at the colonial sales in London, realize higher prices than much finer wools." These extracts leave no doubt as to the blood which is in the highest esteem for wool production simply, in the principal market for worsted wools in the world. To this it may be added that the recent experiments of Mr. Lawes, at Rothamsted, establish the fact that Leicesters rank first in the production of the highest amount of wool per hundred pounds, live weight; after them, in order, are Cotswolds, cross-breeds of the two former, and Sussex, Downs, and Hampshires, and full-blooded Sussex, Downs, and Hampshires.

The remarks preceding apply when the first object in view is the production of wool. But it must be borne in mind that for the abundant supply of combing-wool, as a great national production, the raising of wool must be altogether secondary, to production of meat or mutton and lambs, and almost secondary to the production of manure. Mr. Dodge observes, in the address before referred to—

> Few owners of long-wooled flocks in this country appear to understand practically the difference between fine-wool and long-wool husbandry, forgetting that it is the destiny of the merino to be kept for wool, of the Leicester to be killed for mutton, and holding the mutton sheep upon barely thriving rations for the purpose of shearing once in each year. The folly of such a course is like that of a beef-producer, who should let his animals run in the stock-range and expect the results of stall-feeding. The mutton breeds, like short-horn cattle, are simply machines for converting farm products into meats and fertilizers, the production depending upon the regularity and freedom from friction with which the machinery runs—irregular feeding, an occasional scanty supply, undue exposure to cold or temperature uncomfortably high, reducing inevitably the amount of flesh produced, by neutralizing the amount of nutritive power of a certain quantity of feed. To make mutton with the greatest profit, every pound of hay, roots, or grain fed must yield a fair result in flesh gained. Thus, while wool-growing may be successful in the midst of primitive, almost barbaric, practices in culture, mutton production involves arts of husbandry the most advanced, and a knowledge of animal physiology the most enlightened.

In England the production of combing-wool, the kind in greatest demand, was secured by breeding sheep which would attain the utmost possible weight of mutton, which could be fed to their utmost capacity, and would produce the largest amount of manure. The mutton sheep is at this moment not only the chief animal product of England, but it is what it was declared to be long ago, "the sheet anchor of English agriculture." It is the chief animal product of Great Britain. The statistics published by the Royal Agricultural Society show that Great Britain had, in 1868, 30,711,396 sheep, 5,423,981 cattle, and 2,308,539 pigs. The sheep is literally the basis of English husbandry. The agriculture of England, as a whole, is very simple. Four crops, in regular rotation, and mainly in the same order, constitute her great staples. Turnips, barley, grass, and wheat are said to be the four magical words at which the earth unlocks her treasures to the British farmer. The four-field or four-shift system, which pervades the greater part of the kingdom, consists of this succession. The cash receipts are for the barley and wheat alone; turnips and grass serve mainly to feed the sheep, which furnish mutton and wool to support them in their most important function, that of manuring the turnip-fields upon which they are folded for the four years' rotation. Recent agricultural writers in England affirm this to be the main object of English sheep-husbandry. Professor Coleman, of the agricultural college of Cirencester, in a paper recently read before the Royal Agricultural Society, on the breeding and feeding of sheep, says:

> "It is not difficult to show that sheep alone, apart from their influence on the corn crops, will not pay a living profit, after all the expenses of growing the crops are considered."

Other practical writers for the same journal declare that there is no

profit in growing sheep in England simply for their mutton and wool, but that culture of sheep is still an indisputable necessity, as there is no other means of keeping up the land. It is somewhat surprising to observe, in view of the importance of the combing-wool manufacture of England, how little consideration appears to be given to the qualities or the quantities of the wool produced, the attention of agriculturists being principally directed to the fattening qualities of the animals. The reason is that the best quality of fiber is a necessary consequence of the highest culture of the animal. The early maturity and slaughtering give soundness to the staple, the wool from old sheep being brashy and rough, and the regular supply of artificial food, when pasturage is deficient, prevents that most objectionable feature in poorly-bred wools—a long, spiry, coarse top, with a fine downy bottom. The length of the fiber is also the result of a suitable alimentary regimen, recent physiological observations having established the fact that the form and diameter of the filament depend upon the organization of the animal, while its length is determined by abundant nourishment. The quality of the wool being secured by good husbandry, where there is an extensive worsted manufacture, agriculture need not concern itself about the variety or special character of the fiber. With the infinite variety of fibers every wool which can be combed has its special use, and commerce and the wool-sorters' skill will secure for each its appropriate place.

Cheviot wools.—There is another class of wools occupying a position between combing and clothing wools, or adapted to special fabrics both of worsted and cloth, which, in view of the new developments of sheep husbandry and wool manufacture in this country, deserves more attention than it has yet received. These are the wools of the Cheviot sheep, so extensively bred in Scotland in place of the old Highland breed, and which supply the chief revenue of the vast estates of the noble families of Breadalbane, Argyle, Athol, and Sutherland.

The name of this race is derived from the mountains of Cheviot, in the county of Northumberland, England, extending into the county of Roxburgh, Scotland. The geological basis of this range is porphyritic, the beautiful conical mountains, mostly covered with grasses, ferns, wild thyme, and other plants distinctive of trappian soil, rising to a height of two thousand to two thousand five hundred feet; beyond and in contact with them is the rugged country of the heath, the true habitat of the blackfaced or Highland sheep.

Before the middle of the eighteenth century the Cheviot sheep were confined to this district. A little less than a hundred years ago attention was given to their amelioration, and the new Leicester blood was introduced. The infusion of this blood was the more efficacious, as there is much reason for regarding the Leicesters and Cheviots as belonging to the same type, the Leicester type, as it existed before its amelioration by Bakewell, prevailing in all the countries washed by the North Sea. These sheep moreover resemble the Leicesters in general appearance, being without horns and having white faces and legs.

The race is now diffused in all parts of Scotland, except the rugged heath-covered districts, where the Highland race alone can find sustenance. The number in 1856 was estimated by Mr. Stewart, in a monogram of the race published in the French language, at 3,700,000. In the more southerly counties the sheep-farms are commonly about 2,000 acres in extent. In general only a small part of the farm is cultivated, rarely more than 50 to 100 acres, and that only for winter food for the sheep. About $1\frac{3}{4}$ acres suffice for one sheep, a farm of 1,800 acres sustaining about 1,000 sheep. The artificial food is altogether subsidiary

to the natural herbage of the farm. It is supplied during falls of snow, and consists of cultivated grasses or the produce of the swamps, and the natural perennial grasses. These sheep have the faculty of obtaining their food, even when the ground is covered with snow, by scraping away the snow with their feet, and they prefer the natural food, thus obtained, to dry provender. Protected by their close fleece, which prevents the penetration of rain and snow, they bear with comparative impunity the storms of the Scottish hills. They need shelter only from the driving snow-storms, which are often of terrible severity, the most common shelter being a circular wall, without covering, of six feet in height, with a simple aperture for admission of the animals. Their limbs are of a length to fit them for traveling and enable them to pass over bogs and snows which a shorter-legged animal could not penetrate. Mr. Lowe says that the entire management of these sheep in the northern part of Britain has no parallel in the same latitudes in Europe. In no other country similarly situated are sheep so entirely exposed to the inclemency of the weather without shelter of pens or houses. "Were these sheep," he says, "managed as in other parts of the continent of Europe, penned and fed in houses, and prevented from taking natural food, the mountains of the country could not maintain one-fourth part of the present numbers."

The Cheviots, although bred in purely pastoral regions, are grown primarily for mutton. The breeder in the mountains, however, rarely fattens his sheep or lambs for market. They are turned over, at different ages in different districts, to be fattened by the farmer of the arable lands and lower and richer pastures. When fattened, their mutton is held in the highest estimation. In the more southerly counties the increase of a flock of a thousand sheep is sold as lambs. The selling of the lambs takes place in August, and reaches from 450 to 550, of which three-quarters are male lambs, and the rest young ewes; with 130 to 150 old ewes. These sales, with the washed fleece, make the whole return of the flock. In the north of Scotland the lambs are kept till three years old, and are then sold to be fattened.

The Cheviot sheep breed amalgamates readily with the Leicesters, and a system of breeding has been extensively introduced for producing the first cross of the descent. The rams employed are the pure Leicester breed, and the progeny is superior in size, weight of wool, and tendency to fatten to the native Cheviot. The lambs of this descent are sometimes disposed of to the butcher, and sometimes fed until they are shearlings, when they can be rendered as fat as the parent Leicesters, and not much inferior in weight; and they can also be raised to maturity under less favorable conditions of soil and herbage. The benefit, however, is said to end with the first cross. Mr. Lowe says that there cannot be a question that for general cultivation, in the high and tempestuous countries to which the Cheviot breed is adapted, the race should be preserved in its native purity. Every mixture of strange blood has been found to lessen the character of hardiness, which is the distinguishing character of the race. The beautiful breed of the South Downs would seem to be of all others that which is best adapted to improve the Cheviot; and yet the experiments which have been hitherto made have shown that the mixed progeny is inferior to the native Cheviot in its adaptation to a country of cold and humid mountains.

We have yet to speak of the new claims of this race to the attention of sheep-breeders, resulting from the new demands of manufacture, and the fields recently opened to sheep-husbandry.

The washed wool of the Cheviot sheep averages about three and a

half pounds to each animal. It was formerly used wholly as a clothing-wool. Since the attention of breeders has been devoted to the fattening properties of the race, the wool has increased in length and diminished in fineness. More lately, and until quite recently, it has been principally used for combing purposes. It is finer than the Cotswold wool, and can be advantageously mixed with English combing-wool. The recent application of the Cheviot wool, or a mixture of it, with fine merino wools to certain cloths by the Scotch woolen manufacturers has led to the modern fashion of wearing coarse clothes for business and morning costumes. The basis of the Scotch cassimeres, tweeds, and cheviots is the coarse Cheviot wool spun with a mixture of fine Buenos Ayres wool. The fabrics from this material are liked for hot climates, and have become a demand upon the continent. Even the manufacturers of Elbeuf, in France, so celebrated for their production of fine cloths, have been compelled to import the Cheviot wools, although they complain bitterly of the scarcity and high price. In view of these facts, it can scarcely be doubted that the demand for coarse wools for clothing purposes will be likely to continue, and for the production of such wools no race appears so well fitted as the Cheviot.

The new fields for sheep-husbandry, to which public attention has been recently called, comprising the vast natural pastures between the Missouri River and the Pacific coast, the valleys and plains bordering upon the great Sierra Nevada, where the dried grasses, becoming perfectly cured uncut hay, furnish perpetual resources for winter grazing, and offer inducements for the trial of the Cheviot race. If mutton production is to be attempted in this region, the Cheviot race is worthy of the first attention on account of its hardiness and working qualities. If the cost of transporting live sheep by railroad from the base of the mountains to the Chicago market—as given by Latham, 75 cents per animal—is not underestimated, the Scotch system of breeding upon the mountains for fattening upon the richer lands of the prairies might be profitably pursued.

Carpet-wools.—The questions connected with the production of carpet-wools are of less interest to the American wool-producer, because the culture of the animals producing these wools is not likely to be pursued as a final object where any purpose is entertained of improved sheep-husbandry. Where stocks of these animals are kept, as the Mexican sheep of Texas, New Mexico, and Colorado, they are regarded valuable principally as a basis of improvement by means of higher types, and their wools as points of departure to be hastened away from as rapidly as possible. Still, the economical question of the propriety of encouraging the growth of these wools by legislative measures is so important that we cannot omit the facts and considerations which may throw light upon a subject of practical interest. In starting upon this inquiry it is necessary to refer to the terms of the existing tariff on wools, establishing the basis of the classification, which is:

Third-class, carpet and other similar wools, such as Donskoi, Native South American, Cordova, Valparaiso, native Smyrna, and including all such wools of like character as have been heretofore usually imported into the United States from Turkey, Greece, Egypt, Syria, and elsewhere.

It will be first observed that the name of the class—"carpet-wools"—designates only the most characteristic use. Combing-wools are largely used for carpets, all the whites in Brussels carpets being made of Canada or combing-wools of English blood, generally constituting not less than one-fifth part of the fabric, but this use does not entitle them to the designation of "carpet-wools." This designation really includes all those

wools which are not strictly classed as clothing or combing wools. It is an interesting feature of the present classification that it corresponds with that adopted, upon independent grounds, by the scientific writers upon wool in Europe. M. Moll, the chairman of the jury upon wools at the Paris Exposition, concludes that all the wools of the world are naturally and philosophically classified into three great groups—1. "Heavy wools," corresponding to our third class, or carpet and other similar wools; 2. "Glossy wools," corresponding to our second-class or combing-wools; 3. "Crimped or undulated wools," corresponding to our clothing-wools of merino blood, or first-class, with the single exception of Down clothing-wools. He thus characterizes the first class, corresponding to our third class:

The hairy wools (*laine à poils,*) *Zachelwolle* of the Germans, kempy wools of the English, are produced by the ovine races which approach the savage type. These wools vary much among themselves, as well in the proportion of hair as in its fineness, and in the length and value of this as of the wool. There are some—for instance, the summer Donskoi—of which the down or wool has a fineness almost equal to that of merino wool, which, nevertheless, does not give it the value of the last, because of the abundant hair with which it is mixed, and from which it is impossible to separate it after it has been shorn.

Mr. Moll omits a characteristic feature which is observed in the wools, particularly those of long fiber, in our third class, namely: an inequality in the diameter of the fiber, which often presents a long, spiry, coarse top with a fine, downy bottom, a peculiarity noticed by the Bradford wool-supply committee in the Iceland long-wools. At the time of the official examination of the wool samples collected for the use of the custom-house officers, this characteristic of long carpet-wools was clearly pointed out by wool experts consulted by the examiners.

At first glance it would seem easy to permanently classify wools simply by the races which produce them, as it would be naturally presumed that certain races would invariably produce wool characteristic of their origin. For any determinate period this basis of classification would be correct enough, and the present classification has clearly in view the present products of certain races. But for a truly scientific and permanent method, this principle of classification is out of the question. Mr. Sanson, the most eminent of the modern writers of zootechny, has clearly shown that the specific characters of the species of sheep are established by the forms of the skeleton, and of the head in particular, which are absolutely fixed, and transmit themselves infallibly by generations between individuals of the same species. But he insists upon the absence of any value in the characters of the fleece or the muscular parts which surround the skeleton, as a means of determining the characteristics of the types or races of sheep. He regards the fleeces and muscular forms of sheep as but secondary characters. These secondary qualities, although they may be of the highest importance in view of utility, are the only ones capable of being developed by the art of culture, such as modes of habitation and alimentation. He shows that the form and quality of wool cannot be of any avail, contrary to what is commonly believed, for the determination of the types of sheep, and for the natural classification of their races, but that the form and quality of the wool are dependent upon alimentation and shelter. Although, according to principles laid down by Mr. Sanson, the races now producing inferior carpet-wools may be capable of being so improved by culture in their secondary qualities as to produce combing, or even clothing wools, it is equally true that unimproved, degenerate, and neglected races tend to deteriorate in the secondary qualities, such as those of flesh and fiber. The countries designated in the wool classification as producing the

characteristic carpet-wools are those where no improvement has taken place, except by a partial introduction of the merino blood, and no general term appears more appropriate to characterize the animals producing these wools than that employed by M. Moll, the "half savage ovine races."

The well known expert, Mr. George W. Bond, in his paper on the "Custom-house Wool Samples," published in the first volume of the Bulletin of the National Association of Wool Manufacturers, has shown that the sheep of the countries designated as producing carpet-wools have descended from races quite distinct from those producing clothing or combing wools. The native South American, Cordova, and Valparaiso wool is shown to be produced by descendants of "chourros," or coarse-wooled sheep of Spain. The chourros, as compared with the merinoes, are thus described: "They are larger, longer, and higher upon the legs; they have a head smaller and more tapering; the legs and head are without wool; they are of a robust habit; they are more easy to nourish; they bear hunger and the inclemency of the season better; the wool is straight and longer, much less fine, and much inferior in value." The native wools of Asia, including the East Indies, the north of Africa, and the most southern parts of Europe, are shown to have a common origin—the broad-tailed sheep, the most ancient race known, and which has remained almost without improvement, with the exception, perhaps, of the Karamanian sheep referred to hereafter. The semi-savage character of this race is shown by the name applied to it by Mr. Sanson, "the barbarous type."

That all these wools are justly characterized as carpet-wools is demonstrated beyond question by the uses to which they are applied. The first volume of the Bulletin of the National Association of Wool Manufacturers contains a statement of nearly two hundred importations of wools, of the third class, into the port of Boston during the year 1869, and with scarcely an exception the origin of these wools was in countries designated, in the wool tariff, as those from which "carpet and other similar wools" are "usually imported."

The article introducing this statement was called forth by the assertion made by a wool-growers' association, "that considerable quantities of wool, suitable for clothing purposes, are admitted under third-class duties, paying only 3 cents per pound." The Bulletin says: "Before introducing the statement of importations (third-class wools) we would call attention to some other important facts tending to sustain our position, that "carpet and similar wools," imported into this country, are used exclusively for the purposes intended by the law. We are informed by the appraiser in Boston, Mr. Rice, and the agents of the mills hereafter referred to, that two of the carpet mills which are the largest consumers of the wools of the third class, one of them, the Lowell Manufacturing Company, consuming nearly one-fifth of the whole importation, at the request of the appraiser, Mr. Rice, had an inspection made by experienced sorters, of the stocks of imported wools in the wool-houses, to determine the amount of clothing-wools which they contained; and that this inspection established the fact that these stocks did not contain more than 1 per cent. of clothing-wools—not enough to pay for sorting. In fact, all the wools bought by these two establishments are used exclusively for carpets, not a pound of the wools bought or imported as carpet-wool having been used or sold for any other purposes. This fact is more remarkable and conclusive since the Lowell Manufacturing Company alone imports and uses not less than six million pounds of wool per year, and the purchases are made often by full cargoes, and usually

in large lots. The second fact is that the largest importers of South American wools, Hemmenway & Company, of Boston, have given orders to their agents in South America to allow no mixture of clothing-wools with the wools of the third class bought on their account. Finally, the increase of the carpet manufacture in this country fully accounts for the increase of the importations of these wools. The great increase is in the manufacture of ingrain-carpets, used principally by consumers of moderate means, for no feature of American domestic life is more noticeable than the universal use of carpets, even in the humblest homes."

Mr. Myers, in his effective speech in the House of Representatives, asserts that seven thousand persons are now employed in the city of Philadelphia in the manufacture of these carpets upon hand-looms, and that they use only imported wool. The "Industrial Protector," published in Philadelphia, gives, from facts furnished by a former secretary of the Carpet Weavers' Association of Great Britain, the statement that there are in Philadelphia between four thousand and five thousand hand-looms engaged on ingrain Dutch and Venetian carpets, about nine-tenths of which are working on ingrains; and that the productive power in the United States is 5,200 looms and 800 power-looms, equal to 2,000 hand-looms, making a total production of 7,200 hand-looms; while the total productive power of England is only 2,100 hand-looms. With the vast consumption of wools of the third class, implied in these figures, there is no necessity of resorting to the theory of the consumption of these wools for clothing purposes, to account for their large importation.

It is evident from the above statement that no loop-hole exists in the tariff on carpet-wools for the admission of the clothing and combing-wools at lower duty than the law intends. We are now prepared to meet the inquiry why equally high protective duties are not due for these wools as for combing and clothing wools. The answer is: 1st. That the encouragement of the production of these semi-savage wools is neither desirable nor practicable, because it is more profitable to grow clothing or combing wools. The animals producing these wools will not be grown in populous districts, because they are not producers of mutton; nor in pastoral regions, because they produce less than half the weight of wool of the merino, owing to the less number of coarse-wool fibers on the same extent of surface. 2d. A high duty, not compensated by an increase of production, would check an important national industry, or if a neutralizing duty were placed upon carpets, would tax the consumer to the full amount of the added duty, which is not the case when the production of wool is increased by the duty. Dr. Randall speaks authoritatively upon the question of the profitable production of carpet-wools in this country. Referring to a provision which had been suggested, that all kinds or classes of wool which furnish any clothing or combing wool, should pay the same duties as those two kinds, he says:

What would be the consequence of such a tariff? From the large amount of wool per yard necessarily used in carpets, the imposing of classes 1 and 2 duties would raise the prices of these fabrics to an oppressive pitch on consumers of small means. They now have to pay for them all they care to do. We do not believe in encouraging popular extravagance; but we do believe in placing no unnecessary obstacles in the way of the widest popular enjoyment of those comforts and adornments which both indicate and produce taste, culture, and all that goes to make up civilization. Legislators have no right to render such enjoyments less attainable by enhancing their cost without the most stringent reasons. If protecting duties on carpet-wools were necessary to foster an existing and important national husbandry, which is essential to the public subsistence, to the general agriculture of the country, and to the utilization of the vast portions of the public domain, as is the case with clothing and combing wool husbandry, then those duties would be as justifiable in one instance as in the other; and the same ultimate compensation would be made to the consumer by the re-

duction of prices caused by domestic competition. But duties equal to those on clothing and combing wools will not now, nor probably for generations to come, lead to any extensive production of carpet-wools in our country, because it would cost as much or more per pound to grow them as to grow the former, and the aggregate value of wool and mutton would be less. For our growers, then, to insist that carpet-wools should perpetually pay the same duties as the seriously competing wools, because a comparatively small amount can be, and is, used in clothing and combing fabrics, when, too, as already said, this use finds an equivalent in the use of the latter in carpets, would betray a selfishness so inordinate that it could not fail to disgust the great mass of our people.

The statement that it is not desirable to introduce into this country the races producing carpet-wools, demands some slight qualification. In sections of the country, like Texas and New Mexico, where the Mexican ewes, descended from the smaller and shorter-wooled Spanish chourros, can be cheaply procured, it may be desirable to import them for crossing with merino bucks, as the cheapest and most rapid means of obtaining abundant stock; but in that, the ultimate intent is not to obtain a carpet but a clothing wool. Special qualities, besides the fleece, in races producing carpet-wools and special adaptation to peculiar districts, may recommend their introduction. Such an exception appears to be the Karamanian sheep of Asia Minor. The broad-tailed or barbarous type of sheep found in the north of Africa, Syria, and Asia Minor, although producing in Asia Minor admirable carpet-wools, from which the Turkish rugs and carpets are fabricated, has always been regarded with contempt by European cultivators. A recent work, by the Rev. Dr. Van Lenness, entitled "Travels in little-known parts of Asia Minor," shows that the broad-tailed sheep is carefully cultivated in some parts of Asia Minor, the best breed being raised in Karamania, a high and cold district in the southern portion of the peninsula. Speaking of a district in that region, he says:

A good many flocks of the broad-tailed sheep are pastured here, and the breed raised in the district, as well as farther south, is highly esteemed. It has been a matter of surprise to me that, while so much attention has been paid in Europe to every natural production of Asia Minor, the broad-tailed sheep has not only been neglected, but travelers have always spoken of it with disdain and ridicule. The poor, meek animal's burden—his ponderous tail—which, in the eyes of the natives, constitutes a most valuable prize, is spoken of as an unnatural excrescence. * * I believe, however, that this creature constitutes one of the most valuable possessions of the people of this land, and should greatly regret to see the breed exchanged for any other, not excepting merinoes. True, the wool is not fine, and cannot be employed for the most delicate textures. It supplies, however, what is most needed by the common people—a staple for manufacturing cheap, coarse, and warm garments, and excellent carpets. But the flesh of the animal is superior to any breed on the face of the earth. * * The natives fully appreciate the economical value of the broad-tailed sheep, and it has nearly supplanted every other breed on the peninsula. Fine rams fetch a high price, and you see them kept in all parts of the country solely for breeding purposes. Nor is the broad and heavy tail the least valuable portion of the animal; it is wholly composed of fat, which differs essentially from tallow or any other fat, except lard. Its delicacy enables it to take the place of butter for culinary purposes; and it is, in many respects, so far superior, while, also, decidedly cheaper, that, in most parts of the country, butter is not manufactured, because it is not needed; milk is thus made into cheese only. Moreover, "tail's fat," as it is called, is as much an article of merchandise here as any other necessary or comfort of life; and a market unsupplied with it would be poor indeed. It fetches a medium price between tallow and butter, and is almost entirely used by the natives instead of the latter. There can hardly be a doubt that this animal would succeed in Europe, for it is hardy, and the best breed is raised in Karamania, a high and cold district in the southern part of the peninsula.

No suggestion bearing upon the production of raw material for our industry or means for sustenance is to be slighted, and the feasibility and advantage of introducing, by the same agencies which have effected the importation of the Angora goat from Asia Minor, the Karamanian sheep for culture in the high and arid regions of the far interior, where

they would unquestionably flourish, may possibly be found worthy, in the new demand for coarse wools, of the attention of our breeders.

The space allotted to this article will not permit the discussion of the important practical questions of the preparation and putting up of wool for market; but one question connected with that preparation is too important to be passed by in silence; this is the feasibility of dispensing with the washing of sheep prior to shearing. The testimony presented in the discussions at the Syracruse convention shows that the requirement of this preliminary washing, made indispensable by the present demands of the majority of manufacturers, is regarded as a heavy burden upon the wool-grower. In many districts, as in Texas, this washing is impossible on account of the want of convenient streams of water. In others the process is unhealthful, both to animals and men, from the coldness of the streams; and everywhere, as ordinarily practiced, it is injurious to the sheep, from exposure to wet and cold, and the rough handling to which they are subjected. Mr. Montgomery, the late president of the Ohio Wool Manufacturers' Association, expresses the objections of wool-growers to washing sheep as follows:

> It has been asked why we wish to sell our wool in an unwashed condition. One reason is, that we don't want to subject our sheep to the labor of carrying ten or twenty pounds of wool, soaked with water, and to consequent discomfort and illness, for a week, more or less, until it gets dry. We don't choose to dress them in wet clothes for that length of time. Another reason is, we want to shear our sheep early; and if we undertake to wash them we cannot do it, for the water is too cold, both for the sheep and the men, early in the season. A great many men in our western country cannot go into the water; one is subject to rheumatism, another to ague. A great proportion of our men are foreigners, raw men, not capable of handling sheep skillfully; and then the cost of getting it done is more than the increased cost of getting it to market with the dirt still in the fleeces.

Notwithstanding these sensible objections, the majority of manufacturers, at present, prefer to purchase wools in the washed state. The principal reason for this preference is, that it having been the custom of the country to put the wools in market in a washed state, the manufacturers have become accustomed to form their judgment as to quality and value upon wools in this condition. It is understood that the subject has been brought before the National Association of Wool Manufacturers, but that no disposition has been manifested to recommend a change in the usage of the country. Besides, it is manifest that no change, like that demanded by the wool-growers could be brought about by resolutions of associations or conventions. It may, however, be effected by other influences now in operation. The value of solutions of the yolk of fleeces as a source of potash, as a manure for the land, or for use in the arts, has been demonstrated in France, and is being better appreciated in this country. Methods are being introduced in many establishments for preserving and converting into manure the solutions of yolk obtained by washing the raw fleeces in cold water. Thus the unwashed fleeces have a new value to manufacturers which may gradually lead them to prefer purchasing the fleeces in the raw state. On the other hand, the intelligent wool-grower, seeing the value of those solutions, may be induced to wash his sheep at home, in such a manner that the wash-water, so rich in potash, may be distributed upon the land as liquid manure. This question, upon which wool-growers are so sensitive, will be settled by natural causes, which will tend to bring about the result which is the most economical on the whole. In this, as in all cases, the interest is mutual between the manufacturers and the wool-growers. It is for the interest of the manufacturers that that course shall be pursued by the wool-growers which in the end will enable them, with a fair profit, to give to the manufacturers the

greatest quantity and the greatest value of wool at the lowest cost. The distinction between these two bodies of producers is but nominal, for each is engaged upon different parts of a series of processes by which the raw products of the soil are converted into the clothing of man. They have a controlling interest in common—the permanent establishment of the woolen industry in all its branches, agricultural and manufacturing, upon American soil.

AGRICULTURAL PATENTS OF 1871.

The task of recording improvements in agricultural implements grows more difficult yearly. In the early stages of our history it was comparatively easy to look back upon the efforts of a year and to note the progress made, as the number of inventions was small, and the changes were radical and strongly marked.

In this article it is our purpose simply to take a general survey of the field of agricultural invention for the year 1871, to call attention to that which is most striking, and to indicate the direction of improvement. In so doing we are not to be understood as passing judgment upon the merits of any case. It is possible that the most important inventions which the year presents, have been overlooked, as the examination of so large a number must necessarily be cursory, and cannot often descend to details. Besides, it must not be forgotten that to determine what is novel it is necessary to institute a comparison with previous inventions. If each invention was wholly new, the task would resolve itself into one of mere compilation, but, in most cases, the old and the new are so connected that the latter is generally but an improvement, an addition to, or an alteration of, the former, requiring nice discrimination and careful investigation to determine the dividing line. Many classes, too, must be passed over without specific mention as not of general importance, though intrinsically valuable and important in particular cases.

There are three grand divisions of agricultural machines and implements in the United States Patent-Office.

The first division contains machines and implements devoted to the cultivation of the soil, and is known as the class of "Tillage." It embraces plows, harrows, seeders or planters, cultivators, and the like.

The second includes machines and implements for harvesting the crop, such as reaping and mowing machines, hay-spreaders, rakes, &c.

The third embraces thrashers, straw-cutters, cotton-gins, dairy utensils, and machinery and implements of a stationary character, used under cover.

PLOWS.

While this important implement has received its full share of attention during the past year, as indicated by the large number of patents issued, the improvements are mainly of a character scarcely to be observed in a general inspection.

The points of improvement first to be noted are contrivances to adjust the beam of the plow by elevating or depressing it without changing the relation of the handles to the standard or landside, the purpose of which is to regulate the depth of the furrow according to the nature of the soil or other circumstances. The general character of the invention will be understood by imagining a plow-beam so connected to the standard, by pivot or otherwise, that the outer end of the beam, or the point where the draught

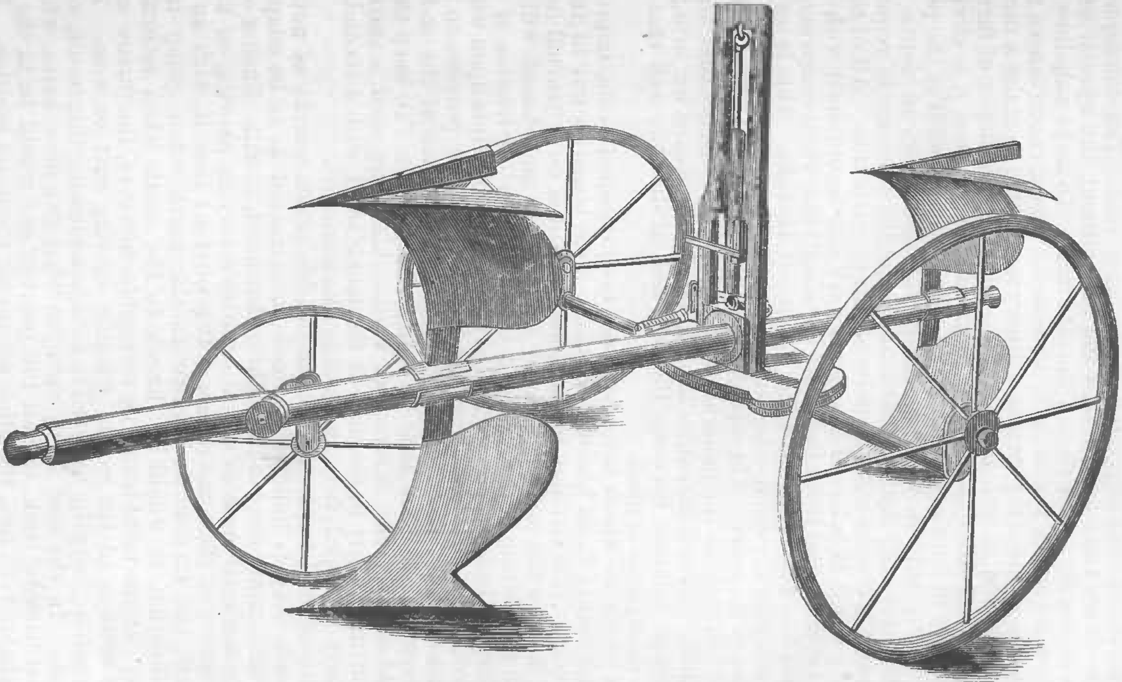
is attached, may be raised or lowered at will. The beam extends rearwardly in the direction of the handles, and is provided with suitable means, such as holes and pins, to regulate the adjustment. To run a deep furrow with a plow of this construction, it is only necessary to raise the forward end of the beam the proper distance, and then secure the adjustment by the means suggested at the inner end. The consequence is that the share runs deeply into the soil without the special effort heretofore necessary on the part of the plowman. To make a shallow furrow, the forward end of the beam is depressed. These contrivances may prove valuable in assisting persons otherwise unable to make a furrow of a particular kind, as well as in securing uniformity of depth of furrow. With a plow without adjustment of parts for this purpose, it is obvious that uniformity of depth must depend largely upon the skill of the plowman, and where skill is wanting, the furrow must vary in depth. It should not be inferred that neither skill, strength, nor care is required for the proper management of a plow of this construction. All of these are needed; but it is believed that good work can be obtained with less executive capacity and labor than with the old style of rigid construction.

Attention has also been turned to the line of draught. This is an old question, nor can it, perhaps, be said that the principle embodied in the devices noted is novel. The specific means patented are *prima facie* novel, and it is only to the general character of these means that attention is called. Several inventors have devised new means for bringing about a closer relation between the real line of draught and that by which the draught is applied.

Another point to which attention has been directed is the improvement of the rotary mold-board. A rotary mold-board is not in these days a novelty; it is circular in form, and mounted on a journal in its center, so that as the sod passes over its face the mold-board will revolve upon its bearing. The purpose is to diminish the friction of the sod, and thereby lessen the draught. Whether the principle upon which this construction is based be true or false, it is not our purpose to discuss. Some persons, however, believe that the friction of the sod on the mold-board is so slight as to be really unimportant. To keep these rotary mold-boards clean, scrapers of various kinds are used, a stationary knife fitting snugly in the dish of the mold-board, with a secondary disk similarly arranged, being a notable illustration.

There are several improvements in hillside plows worthy of notice. By a hill-side plow is understood one so constructed as to be adapted to laying the furrow either to the right or left hand, at will. Such a construction is essential in cases where it is necessary, in plowing on hilly points, to return in the same furrow. It is obvious that if, with an ordinary plow, the furrow be thrown to the north when going in a westerly direction, it would be thrown to the south when returning eastwardly. If the mold-board be reversible, however, the furrow may be thrown always to the north, whether driving east or west. The means heretofore generally resorted to for accomplishing this result, were of two kinds. In the first there were provided two plowshares, which were placed back to back, so that the point of one would be in the direction of the driver's feet, the other occupying the usual position. The rear share did no duty while in that position, but on reaching the end of the furrow, the horses, with the beam and handle of the plow, were turned around, bringing the rear mold-board in front, and the other in the rear. In the second style there were employed also two plowshares, a right-hand and a left-hand share; one situated in the customary position, the other mounted on the top of the beam. On reaching the

PLATE XX.



GANG PLOW.

[Patented November 7, 1871.]

end of the furrow the position of the respective shares was, by a turn-over movement, reversed, so that the right-hand share, if it had been down, would be brought to the top of the beam, the left taking its place in the soil, and *vice versa*. Among the patents of the year there is a sulky gang-plow of this construction, and really the only one of the gang class patented during the year in which we note features worthy of special mention. This construction, with double shares, is objectionable on several grounds; it is expensive, and renders the plows heavy and rather unwieldy.

To obviate this objection we note several improvements. In one the mold-board is so made and hinged that it can be turned like a door from right to left, the point, sole, and land-side remaining in the same position. In another the point, land-side, sole, and mold-board are formed in one piece and swiveled on a horizontal shaft in such a manner that, on raising the plow, the whole share can be turned from right to left, or in the reverse order, with slight difficulty. There is a patent, also, in which, while there are two complete shares employed, the shares are so constructed and arranged that one hangs by the side of the beam while the other is being used. The shares are so connected that the bringing of either into the desired position raises the other to the side of the beam. The change is easily effected, and without any movement of the team or of the plow-handles or beam.

A few stubble-cleaning attachments for plows are also noted. The first shows a rake in the form of a rotary harrow, provided with a vertical shaft, which passes through the plow-beam, and to which a revolving motion is communicated by means of cog-gearing from the beam-wheel. In the second instance there is a rake of complex construction, also provided with a vertical shaft. It is placed in the rear of the mold-board, however, and is caused to rotate by the contact of the sod in its passage over the mold-board.

STEAM-PLOWS.

Before leaving the department of plows, a word must be said in reference to those which are impelled by steam-power. A brief mention will suffice, for though we find no less than thirteen patents in this class for the year, but few of them are deemed worthy of special notice.

Of these thirteen, one is intended to be dragged across the field by means of a chain or cable and stationary engine, according to the well-known plan. The improvements claimed are of minor importance, and are merely intended to increase the efficiency of the machine. The other twelve carry their own power. Of these, two belong to the class known as rotary spaders. Among the ten may be found two provided with propelling legs, designed to push the engine and plow along; another claims as an improvement the provision of blocks shaped like a horse's hoof, and placed upon the periphery of the traction-wheels. In another, the machine carries and lays its own track in the manner of some road-engines, causing a rotary motion in a horizontal shaft located at or near the hind part of the bed. This shaft is connected by suitable gearing to a driving-wheel suspended beneath the bed of the engine. This driving-wheel, it is understood, does not touch the ground, but is provided with an endless chain, the alternate links of which are made with ridges that mesh into suitable recesses on the periphery of the wheel. At some distance in front of this driving-wheel is located another wheel of like dimensions and construction, hung in a similar manner. The endless chain referred to also engages with this wheel, so that when steam is applied, the wheels are revolved and the chain travels over them. At

regular distances along this chain is placed a series of metal plates, constituting the feet of the machine, and shod with wooden shoes about two inches thick. At each end of the feet is placed a roller of some ten inches diameter, and upon these rollers rest the tracks or ways attached to the under side of the bed of the engine. Thus it will be seen that the body of the engine rests and moves upon a series of rollers attached to feet, which are automatically raised from the ground, carried forward, and deposited again in front, to be passed over regularly. In other words, the machine carries and lays its own track. Its operation is precisely as if a series of rollers were attached to ties laid in a straight line across the field and the engine dragged over them. The only difference is, that in this case the ties are chained together and are picked up, carried along, and used continually. The construction will easily be understood by reference to the well-known endless-chain horse-power. The means used in the case under consideration to propel the carriage consist of just such an endless carrier, arranged to come in contact with the ground—two feet being always on the ground and three off. It ought to be remarked that this principle of propulsion for steam-plows is not for the first time applied. In this case the real novelty, aside from detail, consists in combining the traveling feet with suitable guiding mechanism. The engine is guided by means of two forward wheels mounted on pivoted axles, and so arranged as to be turned right or left at will. The plows, which are of ordinary construction, are connected to the rear part of the machine, and are arranged for the necessary vertical adjustment.

We are informed by a correspondent who witnessed the operation of this steam-plow last fall in a field near Philadelphia, that it did some remarkable work. The engine itself appeared to be defective mechanically, and open to improvement, but the method of traction and guidance seemed to work well. On the occasion referred to, a gang of six plows was attached to the machine, steam was got up, and the engine started. The field was traversed for about a quarter of a mile, the plows being pushed in almost to the beam, and the engine moving at a rate that required pretty rapid walking to keep up with it. On reaching the end of the field the plows were unyoked and the engine turned around. The plows were then again connected with the engine and a return to the starting-point made. There were the hitches and balks incident to a first trial, but the experiment was measurably a success.

To afford an opportunity to those interested in steam-culture to study the inventions thus briefly mentioned, we append a list of the patents granted during 1871 for steam-plows and land-carriages, or traction-engines designed for drawing plows. The specifications may be had on application to the Commissioner of Patents; the cost of a specification and drawing in each case being but 25 cents, or 10 cents each when twenty or more are taken.

I. P. Tice, January 31; O. Hyde, January 24 and October 17; J. R. Morris, March 28; S. H. Gibbs, June 27; M. M. Lynn, July 4 and 25; S. Ryder, July 18; H. Miller, August 15; W. H. Heydrick, August 15; W. C. Bibb, September 26; Robert C. Parvin, October 10.

CULTIVATORS.

The number of patents obtained during the year for improvements in cultivators affords sufficient proof that this very meritorious class is not neglected, but the general character of the improvements is similar to that of previous years. We note but three improvements of special

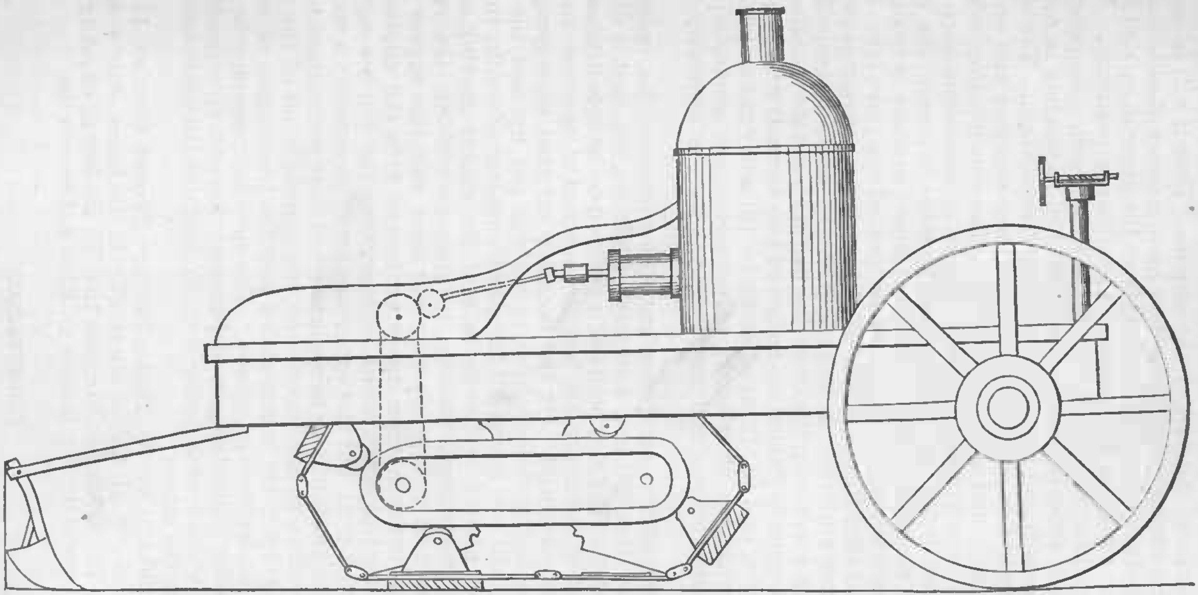
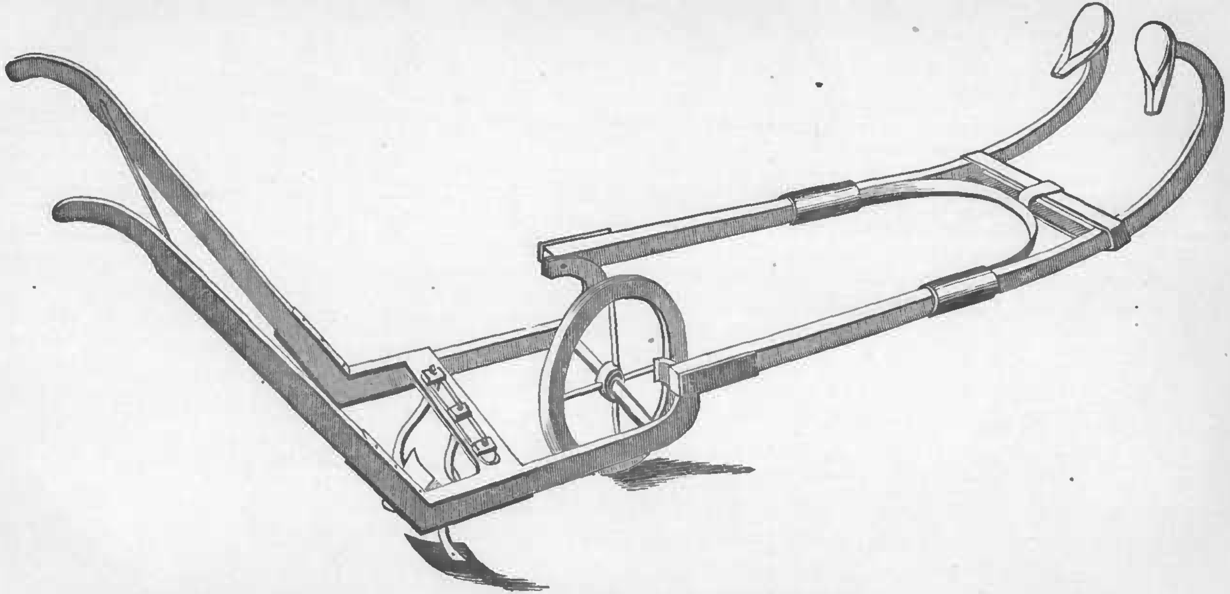


PLATE XXI.

PARVIN'S TRACTION ENGINE.

[Patented October 10, 1871.]

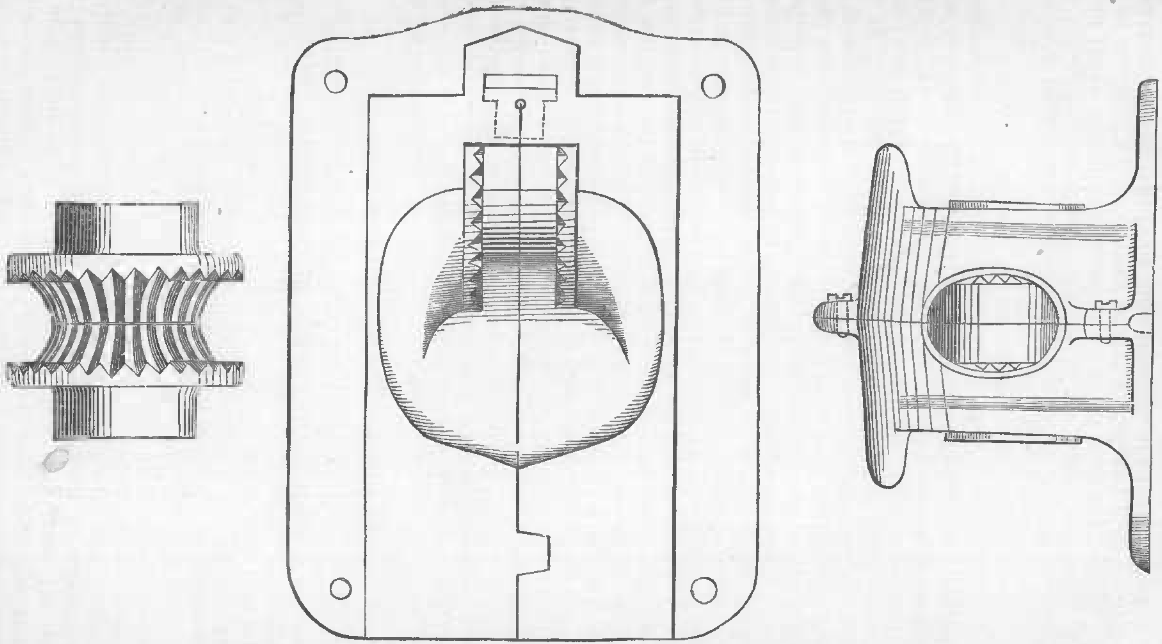
PLATE XXII.



CULTIVATOR.

[Patented June 6, 1871.]

PLATE XXIII.



SEED DRILL.

[Patented February 28, 1871.]

novelty in this class. The first is a cultivator constructed without wheels, but with skeleton runners forming part of the frame, and so arranged that on turning over the cultivator it forms a sled. The simplicity of the machine commends the improvement, as it is obvious that it could easily be constructed on the farm and with but slight expense. It is, however, but just to say that the idea embodied in it is not altogether novel, as reversible harrows with sled-runners were constructed many years ago. One of the other patents, departing from the usual direction of improvements in this class, shows a beam, handles, and standard of ordinary construction. The shovel is about four times the usual width, and is secured to one side of the standard instead of in front of it. It lies almost flat upon the ground, at an angle of about forty-five degrees with the side of the standard. The back of the shovel has a number of long tines or fingers, and upon the upper surface of each of these is a knife-like projection, the purpose of which is to cut up the soil in its passage over the fingers. In the third and last improvement to be noted in this class, there is a series of ordinary cultivator-teeth, from the rear side of each of which extends a piece corresponding in size, construction, and position to the landside of an ordinary plow.

CORN-PLANTERS AND SEEDERS.

The improvements in this class during the past year present few points of great value or special importance. It must not be forgotten, however, that little things of apparently trifling value often help greatly to reduce the cost of manufacture, or improve the efficiency of the machine. Some patents of seeders or grain-drills exhibit improvements in the construction of the seed-wheels. These wheels are generally constructed with recesses or pockets on the periphery, into which the grain falls from the hopper, and by which it is conveyed to the flukes or tubes. In the cases referred to, the pockets are on the side of the wheel, or partly on the side and partly on the outer rim, the hopper-bottom being suitably constructed to permit the free flow of the seed. We note, also, an improvement which may be adapted to the planting of corn or to the sowing of other cereals. In front of the seed-tube is placed a rearwardly inclining furrow-opener, which is tubular at its lower end. Into this tubular opening the seed is discharged through the tooth into the ground. The effect is the same as if the tooth were constructed with an elbow or bend near its lower extremity, so that the passage of the seed from the wheel would be interrupted just before reaching the ground. The result is that the seed is collected and passed out in a more compact stream than if the flow were not impeded. It is also obvious that the seed-tube, which is not by this construction made to do duty as a furrow, or drill-opener, can be constructed of lighter and cheaper metal than heretofore.

HARROWS.

The only notable improvement in harrows is one in which the teeth alone, instead of the frame and teeth, are made to rotate. The frame is made of three side-pieces, so secured as to form a triangle. Each of the teeth is made of a single piece of flat metal, cut also to form a triangle. The extremities or points of this triangle are turned down, forming the teeth, and through the center of the triangular metal piece passes a bolt, upon which the triple-fanged tooth revolves automatically when the harrow is dragged over the ground. The great advantage of this invention, if effective, is that it will act upon the soil equally on both sides—a well known defect of the ordinary single rotary harrow

being that it scratches well on the depressed side, but leaves the other side almost or wholly untouched.

Several recent patents exhibit a construction which, though not novel at this day, is perhaps not widely known. Usually, in these cases, no teeth are provided, the disintegration of the soil being effected simply by the under-side of the harrow-frame, which is made solid and provided with a series of ribs, much resembling those on the common wash-board.

POTATO-DIGGERS.

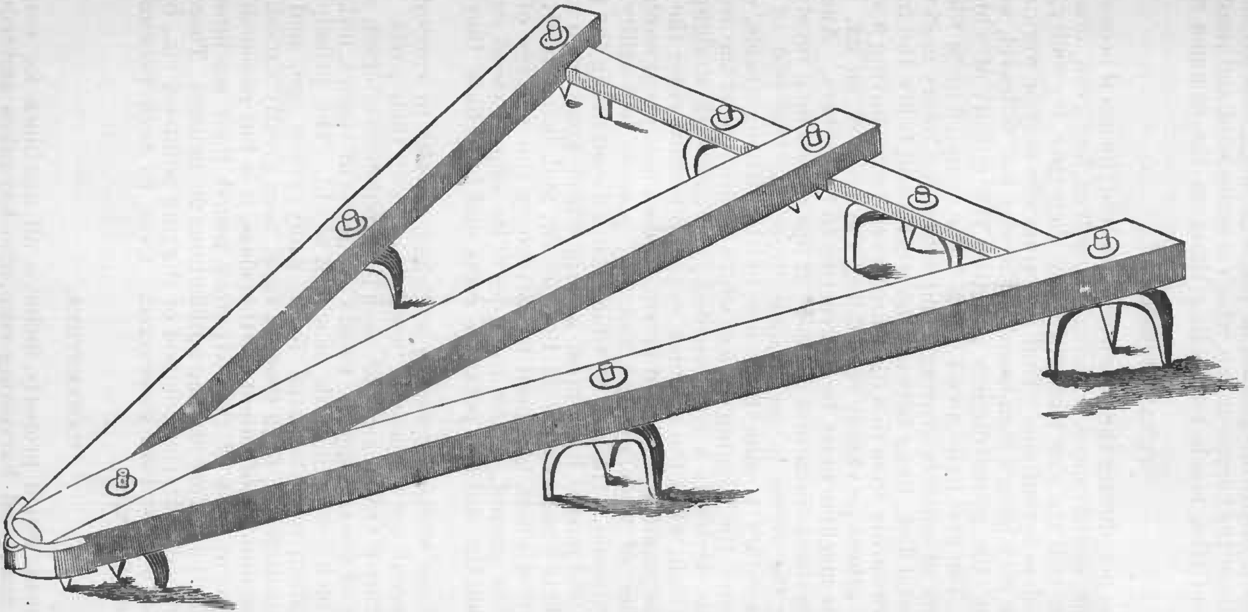
This class has not, during the past year, received the usual accessions of impracticable contrivances. Enough, however, has been done to prove that there still are men who will waste their time, ingenuity, and money upon useless inventions. That inventors who may be working in this department may have a sign-board of the way not to travel, we describe several of the potato-diggers patented, the novelty of which is unquestioned. The first to be noted has a frame mounted upon wheels, which, by means of suitable gearing, communicates a rotary motion to a large horizontal disk, hung between the wheels and below the frame. Extending downwardly from this disk are several arms having a spiral curvature, and otherwise closely resembling the horn of an ox. The operation of this machine must be destructive to the tubers. Another invention shows also a frame and wheels. It has a horizontal revolving-shaft, crossing the frame in an oblique direction. One end of this shaft receives a rotary motion from one of the driving-wheels, while its other end bears the digging-device, which is situated at the rear of the frame. This device is a concave disk, provided with straight fingers, or rays, which, when the machine is put in motion, enter the hills and mutilate the potatoes. A third invention does not appear so objectionable as either of the foregoing, and may possess real utility. It has an ordinary scoop, by means of which the soil containing the potatoes is raised and passed back upon a large wheel hung upon a horizontal axle. This wheel travels in the furrow, and, being really the driving or traction wheel, is caused to revolve by the passage of the machine over the ground. From the sides of its felloes extend curved tines, upon which the soil and potatoes drop, and by which they are separated.

These inventions, while possessing sufficient novelty to warrant the granting of a patent, are not new in principle or in all their parts. The records of the Patent Office, and the models on public exhibition, show that this theory of unearthing the tubers by means of spades, forks, or tines arranged on a revolving disk or wheel, is old. The principle or idea was embodied, in substantial form, many years ago, and the method of application has, from time to time, been greatly varied. In view of the large number of patents of this class, it is but reasonable to suppose that some at least of the inventors tested their machines to their own satisfaction before making applications for patents. There are persons who contend that this method of digging potatoes, viz., by revolving tines, is the best ever discovered. Even to such persons our criticism may be of service.

HARVESTERS.

Under this head, which properly includes all machines for reaping grain, mowing grass, and harvesting corn, also hay-rakes and tedders, straw-binders, and elevators, is found a large number of useful and important inventions. During the year each division of the group has

PLATE XXIV.



HARROW.

[Patented March 28, 1871.]

received its due share of attention, but the efforts are not generally of a character to demand detailed notice. In reaping-machines two objects seem to have been kept in view by inventors: The first; to produce in one machine a combination of all the devices necessary for cutting the grain and binding it in bundles. Cutting devices have been brought almost to perfection. The raking, too, and laying in gavels, are accomplished in a way that leaves little or nothing to be desired. The binding, however, has not been so well done. So far, about a hundred patents have been taken out for binders, of which a dozen or more were issued during the past year, but it is only within a very recent period that satisfactory results have been attained. The difficulty will be appreciated upon reflecting that a good binder should be able to tie knots, not one alone, nor two, nor three, but an unbroken succession of knots. To accomplish this, wire has been employed, for the reason that a mere twist would keep the ends of the wire band together; but there are strong objections to the use of wire. It is, perhaps, no more costly than twine, but the band is hard to cut or loosen, and it is, besides, very unpleasant to have pieces of it get into the thrashing-machine. During the past year at least one patent was issued in which the binding-wire is fed from two spools instead of from one, as heretofore. The wires from the two spools are first brought in contact and the two ends twisted together; they are then brought up around the bundle of grain and again twisted. This second twist is cut in the middle, so that the wires from the spools remain united, and each sheaf has a band formed of two pieces of wire united by a twist at the top and bottom. The best material yet discovered for sheaf-bands is twine. It is cheap, light, easily cut, and makes the bundle secure if a good knot be formed. Without describing the many ingenious devices intended to effect this operation, we may state that success seems to have been attained. A disinterested person informs us that during the past summer he witnessed the operation of a binder which tied bundle after bundle to the number of fifty or sixty without break or stoppage. Twine was used for the band, and each knot, to use our informant's expression, was a good, square knot. The machine was worked by two horses and a driver, no attendants being required.

The second object apparently kept in view by inventors is to reduce the number of persons employed to the minimum. It has been customary in the past to employ not only a driver but an attendant, who rode on the machine and raked the cut grain into gavels. Behind the machine followed the binders in sufficient number to bind the grain and clear it out of the track over which the horses must travel on their next turn around the field. The importance of an invention which will automatically rake and bind will be appreciated when it is remembered that with such a machine the services of the attendant for raking and the binders who followed may be dispensed with.

In devices for raking alone we note a certain class of improvements which deserve mention. We refer to a construction in which the reel or device employed for beating down the grain is also made to do duty as a rake. A combined reel and rake has been used in the past, but so many patents having reference thereto were issued during 1871 that we note the fact. In some cases the ordinary four-armed reel is used, and mounted on the same shaft is another arm, provided with rake and teeth, and so arranged as to sweep the platform at every revolution of the shaft. It is obvious that this construction cannot be well applied except where the grain is rather thin, for if the grain were thick a larger body of it would be accumulated upon the platform than could be conveniently taken up in one sweep, unless the reel should revolve with great rapidity.

In other cases a more complicated reel is used, and each arm serves as a rake, evidently designed for thick-growing grain.

In the other divisions of the harvesting class there has been a large number of patents granted; but our examination does not disclose any noteworthy improvement, the object aimed at being generally perfection of details.

MISCELLANEOUS.

The miscellaneous class of agricultural implements, machines, and devices is large and varied, and has received many accessions during the year. The remarks made in reference to the minor character of the improvements appear to apply with doubled force here, however, for, with careful scrutiny of the class, we have not been able to discover in any of the larger divisions, such as those of churns, bee-hives, thrashing-machines, straw-cutters, &c., any invention of a revolutionary character, nor any special line of improvement.

In the smaller divisions we notice several improvements which might, in another relation, be deemed worthy of notice, but they bear so small a proportion to the whole number patented that it would seem invidious to particularize them.

NUMBER OF PATENTS OF 1871.—The total number of agricultural implements for which patents were granted during the year 1871 is 1,200, subdivided into classes as follows: Bee-hives, 73; churns, butter and cheese making implements, 90; corn-huskers, 13; corn-shellers, 15; cotton pickers, scrapers, cleaners, choppers, &c., 16; cultivators, 90; diggers, 21; egg carriers, hatchers, detectors, &c., 10; feed and straw cutters, 30; forks—hay, manure, &c.—20; fruit-gatherers, 12; flower stands, pots, &c., 10; harrows and rollers, 40; harvesters and attachments, reapers and mowers, 160; hay tedders, loaders, &c., 25; hoes, 11; milk cans, coolers, stools, &c., cow-milkers, 24; planters, drills, seeders, &c., 177; plows and attachments, 160; pruning-implements, 20; racks, feed, hay, &c., 5; rakes, 36; thrashers, separators, and cleaners, 72; miscellaneous, 70; total, 1,200.

Among the miscellaneous patents are coops, cattle-ties, flax-pullers, garden implements, grafting tools, hog-snouters, hedge-trimmers, hair-clippers, insect destroyers, pokes, root-cutters, sap-collectors, tree-protectors, transplanters, vases, vine-trellises, &c.

WEIGHTS AND MEASURES OF THE STATES.

The Federal Constitution conferred on Congress authority to establish a uniform system of weights and measures. There has not been, however, any direct legislation looking to the establishment of a distinctive or national system. Early in the history of the Government public attention was called to the importance of the subject, and elaborate reports and articles concerning it were prepared by Mr. Jefferson, Mr. John Quincy Adams, and Mr. Hassler. Under the direction of Mr. Hassler, then of the Coast Survey Office, sets of weights and measures were prepared, agreeing with those used in England prior to the year 1825; and by joint resolution of Congress, approved June 14, 1836, the Secretary of State was directed to furnish copies of these standards (to be manufactured by the Government) to custom-houses, and to the governor of each State. In this manner a practical uniformity has been attained.

The States generally have established laws concerning the care, management, and use of these standards, for the accommodation of the public, and to guard both buyer and seller against fraud and imposition. The bushel, gallon, pound, &c., are therefore provisionally the same in each State. But the weights per bushel of many agricultural products vary in different States, according to the requirements of local law or custom; and much confusion and misunderstanding result from these different standards. It is designed in this article to present a statement in brief of the legal requirements of each State in regard to weights and measures, for information and guidance in rural traffic.

MAINE.—The treasurer of each county is provided with a full set of standard weights and measures, accurate copies of those in possession of the secretary of State, which are to be tested at least once in every ten years. A sealer of weights and measures is appointed for each town by its municipal officers. Any city is allowed to purchase and keep for use scales for weighing hay and other articles, and to appoint weighers, and fix their fees. Sealers are required annually, in May, to give public notice of a time and place at which they will attend to the proving and sealing of weights and measures, and they are permitted to deface or to destroy those which do not or cannot be made to conform to the standards. They are also required to visit all places where weights, measures, scales, &c., are used, to ascertain if there has been neglect in sending the same to be tested. In all cases of weighing, the vibrating steelyard, invented by Benjamin Dearborn, and that of Dearborn, improved by Samuel Hillis, or Fairbanks's scales, are allowed to be used, after having been submitted to the proper tests by the public sealer. Any person using in public marts weights or measures not conforming to legal standards is liable to a fine of not less than $1 nor more than $10 for each offense, one-half for the use of the town, and the other for the sealer or the prosecutor. The fees of the sealer are as follows: Platform or hay scales, weighing 6,000 pounds or more, $1; weighing 1,000 and under 6,000 pounds, 50 cents; weighing 600 and under 1,000 pounds, 25 cents; weighing less than 600 pounds, 10 cents; for any other scale or steelyard that weighs with a poise, 5 cents; for each dry measure, and for all weights, measures, scales, or beams, 3 cents each, and a reasonable compensation for all repairs, alterations, and adjustments. Hay, pressed or put up in bundles, must be branded on the bands or boards with the first letter of the Christian and the whole of the surname of the person putting it up; also the name of the State and place of residence of such person. If these regulations are not complied with, the hay is liable to forfeiture, one-half the proceeds of sale to go to the town, the other to the person libeling. The laws are enforced throughout the State.

NEW HAMPSHIRE.—Sealers of weights and measures are appointed by the governor, to hold office at will. Sealers are required to prove county standards by those in the office of the treasurer of State once in three years. Fees for testing, 6 cents for each scale-beam, steelyard, weight, or measure, whether sealed or not. Town sealers are required to test their standards by those of the county at least once in three years. Fees for each scale-beam, steelyard, weight, or measure, whether sealed or not, 2 cents, except that after first sealing only 1 cent may be charged for each, so long as they continue just with standards. For using false weights and measures, the party offending is liable to a fine for each offense of not less than $1 nor more than $10, one-half to the use of the prosecutor.

VERMONT.—The statutes require county treasurers to preserve stand-

ards sealed by the State treasurer, and the town treasurer to keep standards proved by the county treasurer. Fees for each article sealed, 10 cents, and reasonable compensation for alterations. One bushel and three-quarters of a peck, standard measure, are deemed the measure of a bushel of charcoal, lime, ashes, potatoes, or apples. Of "India wheat," 46 pounds make one bushel.

MASSACHUSETTS.—The State treasurer is required to furnish each town with a full set of standards, copies of those in his office, received from the National Government. All town standards must be tried, adjusted, and sealed at least once in ten years. Sealers must, in May of each year, advertise in some newspaper, or post up notifications, for weights and measures, balances, scales, and beams, to be brought to a specified place for sealing. They are required to go annually to every hay-scale, or platform which cannot readily be removed, and try, adjust, and seal. Fees allowed for every weight, measure, scale-beam, or balance, (except platform,) 3 cents; for sealing platform balance, weighing 5,000 pounds and upward, $1; under 5,000 pounds, 50 cents, and reasonable compensation for repairs, alterations, and adjustments. Vibrating steelyards must be tried, proved, and sealed annually. The penalty for using unsealed weights, measures, &c., shall not exceed $20 for each offense. Every measure by which salt or grain is sold, in addition to being conformable in capacity and diameter to the public standards, must have a bar of iron across the middle, at the top, and a bar of iron from the center of the cross-bar to the center of the bottom of the measure, to be approved by a sealer. The striking of this measure must always be lengthwise of the bar first described. The penalty for using any other measure is 50 cents for every bushel of salt or grain measured; but salt may be measured in tubs or in any proportional part of the hogshead, without bars, as may be determined by any city or town. Penalty for false measurement of any product by bushel, $2 for every bushel. Weighers of hay are appointed by the officers of towns and cities. Pressed hay must be branded upon the crate with the first letter of the Christian name and the whole of the surname of the packer, and the name of the city or town and State where it is pressed. Penalty for failure to comply with the law, forfeiture of the hay, one-half the proceeds to the prosecutor, the other half to the town. The provisions of the law are not faithfully adhered to in small towns and remote places.

RHODE ISLAND.—In this State the governor appoints a State sealer of weights and measures. The standards supplied to each town are compared once in three years. Weights, measures, &c., must be taken to local sealers once a year, to be tested and sealed. Fees, 3 cents for every weight, measure, scale, or balance, except platform balance; for each platform balance made for weighing 5,000 pounds or upward, $1; weighing less, 50 cents. Penalty for using unsealed weights and measures, $20. City and town councils may make ordinances and regulations, not repugnant to law, relating to the purchase and sale of merchandise or commodities.

CONNECTICUT.—The State treasurer takes charge of the public standards, and supplies copies to the treasurer of each county. Town sealers are elected annually. Weights, measures, steelyards, beams, and balances must be annually sealed, notice being given in April as to time and place of sealing. Penalty for using unsealed weights and measures, $2 for each offense, one-half to the sealer, whose duty it is to prosecute. In the sale of charcoal, fruits, vegetables, and other articles sold in heaped measure, 1,282 cubic inches constitute a half bushel.

NEW YORK.—A superintendent of weights and measures is appointed

by the governor, lieutenant governor, and secretary of State, or any two of them, to hold office during their pleasure. It is his duty to correct the standards of the several cities and counties, and to provide them with such standards, balances, and other means of adjustment as may be necessary, and as often as once in ten years to compare them with those in his possession. The board of supervisors of each county, at their annual meetings, appoint a county sealer, who provides such standard weights, measures, and balances as may be wanting, and compares these standards with his own as often as once in five years. Fees for sealing every beam, 10 cents; weights, 10 cents each; liquid and dry measures, 10 cents for each measure, and reasonable compensation for conforming weights and measures to standards. For using weights and measures, not conformed to standards, the party offending is subject to a fine not exceeding $5 for each offense; he will also be liable to an action at law, in which the defrauded person may recover treble damages and costs. It is incumbent upon every person keeping a store, grocery, or other place where commodities are sold by weights and measures, to have the same compared with the standards in the hands of the sealer once every year, failing in which he is liable to a fine of $5 for each offense, to be recovered by any person who may prosecute. All commodities sold by heaped measure must be heaped in the shape of a cone as high as the article will admit.

NEW JERSEY.—The State secretary is charged with the keeping of the State standards. Each county is supplied with copies, to be preserved in the office of the county clerk, who acts as sealer of weights and measures. County clerks are required in March of every seventh year to give notice requiring all persons within their respective counties to present for testing all weights and measures used in buying or selling. The fees are 2 cents for every article sealed. Penalty for using unsealed weights and measures, not less than two nor more than five dollars for every offense. The law is generally enforced throughout the State.

PENNSYLVANIA.—Counties are furnished with copies of standards by the secretary of State. These are to be tried, corrected, or renewed, under the direction of county commissioners, at least once in five years. County sealers are appointed by the governor, who must go at least once a year to stores, houses, stalls, and offices of the makers, venders, or proprietors of beams, scales, weights, or measures, and adjust and seal them. Fees for trial and balancing of scales, 10 cents; patent balance, 25 cents; coal or hay scales, $2; bushel, 20 cents; half-bushel, 15 cents; peck and half-peck, 10 cents each; quarter of a peck, 6¼ cents; gallon, half-gallon, and quart, 4 cents each; pint, or less, 3 cents; every twenty-eight pounds or more, 12½ cents; lesser weights, 4 cents each, and additional compensation for labor and material used in adjusting. Penalty for using false weights and measures, $10.

DELAWARE.—The State secretary is made the custodian of the public standards, by which he is required to prove those of the several counties once in five years. A regulator of weights and measures is appointed by the governor for each county, who is to serve four years. This officer is required to regulate all weights and measures every two years, free of charge, and to receive a fixed salary from the county for his services.

MARYLAND.—The county commissioners, when not otherwise directed by local law, appoint some person as keeper of the standards of weights and measures. All weights and measures must be inspected once in each year. Penalty for using unsealed weights and measures, $20 for each offense; the same penalty for using scale-beams unstamped.

Any person neglecting or refusing to have his beams, scales, weights, or measures inspected and adjusted, when required by the proper officer to do so, is liable to a fine of $5 for every day of delinquency. False weights and measures may be seized in forfeiture, and sold at public auction. One-half of all fines goes to the informer. These provisions do not apply to the city of Baltimore, or to any private housekeeper not in trade or pursuing some kind of merchandise as a business. In measuring fruits, the measure must be filled even, without rise or heap; penalty for violation of this provision, $5. Oats must be sold by struck measure, and potatoes by weight, 56 pounds to the bushel. Penalty for violation of these provisions, $10.

VIRGINIA.—A State superintendent of weights and measures is appointed by the governor. Each county and corporation must supply itself with standards, conformed to those of the State, which must be tested once in ten years. The scales, balances, weights, and measures of persons doing business must be tested by local sealers once a year. At least once in three years the sealer is required to visit all houses, shops, and other places where scales, weights, and measures are used, and verify them; it is his duty to destroy all weights and measures which cannot be made to conform to standards. The county court may appoint more than one sealer, and assign districts. Fee for every weight, measure, scale, or beam, 5 cents; for steelyard, 10 cents. Any person may call at any time upon the superintendent in Richmond, or upon a sealer of weights and measures in his county or corporation, and have weights, measures, &c., tested and proved. Double fees may be demanded if such service is rendered at the house, store, or shop of the person applying. For using scales, beams, weights, or measures, not sealed, or conformed to standards, a penalty of $5 for each offense is prescribed. Weigh-masters of live-stock receive 3 cents per hundred pounds on each head of cattle, and each hog weighed.

WEST VIRGINIA.—The laws relating to weights and measures are the same as those of Virginia.

NORTH CAROLINA.—Each county is supplied with standards. Persons using weights, measures, or steelyards are required to take them to the county standard-keepers, to be tried at least once in every two years, under penalty of $50 for failing to do so. For buying or selling by false weights and measures, a penalty of $40 for each offense is prescribed.

SOUTH CAROLINA.—The clerks of county courts are made the custodians of the standard weights and measures established by law.

GEORGIA.—All persons engaged in selling by weights and measures must apply to the clerk of the inferior court of their respective counties, and have their weights and measures sealed; in default, they cannot collect any account, note, or on other writings the consideration of which is any commodity sold by their weights or measures. Any citizen may enter complaint before the clerk of the inferior court as to the deficiency of any weights or measures, whether sealed or not, and, if the charge is established, the person offending is deemed a person selling by false weights and measures, and may be presented by the grand jury as such, though no person appear and indicts.

ALABAMA.—The counties are supplied with standards, judges of probate acting as sealers. Fee, 25 cents for each weight and measure sealed. Penalty for selling any commodity by weights or measures not corresponding with standards, $10, recoverable by any person bringing suit.

FLORIDA.—If any person knowingly sell by false weights or measures

he is deemed, under the law, a "common cheat," and, on conviction, may be sentenced to a fine not exceeding $1,000, or to imprisonment for not more than six months nor less than three months.

TEXAS.—The county courts are allowed to grant licenses for making and vending measures agreeing with the standards of the State. The chief justice of each county is charged with the duties of sealer. Fees, for sealing steelyard, balance, or beam, 50 cents; for every weight or measure, 10 cents; penalty for using false or unsealed weights and measures, $10 for every month the party continues to use them. For using false weights and measures, with intent to defraud, the party offending is liable to a fine not exceeding $300, and the weights and measures may be seized by the sheriff of the county. If any public weigher fraudulently make use of weights and measures, he is liable to a fine of not less than $100 nor more than $500, or imprisonment not exceeding one year.

LOUISIANA.—The governor appoints, for a term of two years, sealers of weights and measures, for cities and parishes. Sealers must visit all places of business once in each year, or at any time when complaint is made, or when requested to test weights or measures. Fees for testing and sealing steelyards, scales with their weights, balances with their weights, the bushel and its parts, the gallon and its parts, 25 cents each; for each weight and measure, 5 cents. Penalty for buying or selling by any other than standard measures, for each offense, $50, besides forfeiture of weights or measures; also, a fine of $10 when weights and measures are found just but not stamped—one-half to the informer.

MISSISSIPPI.—All counties are required to supply themselves with verified weights and measures. The owners of mills are required to keep sealed measures. All grain must be measured by struck measure, under penalty of $5 for each failure. Penalty for using false weights and measures, $20 for each offense.

ARKANSAS.—Clerks of county courts act as sealers. It is made the duty of every constable, in his township, to inspect, from time to time, the weights and measures used by millers, merchants, peddlers, grocers, and other dealers using weights and measures, and to report to some justice of the peace all violations of the act concerning weights and measures. For using false weights and measures, the penalty is $10 for each offense.

TENNESSEE.—County courts appoint standard-keepers, or sealers, for their respective counties. The corporate authorities of any city or town may also appoint like officers. All persons or corporations weighing or measuring for the public, in barter and sale, must, once in each year, have their weights, measures, and other apparatus proved and sealed. For neglect, the delinquent is liable to a fine of $5, one-half to go to the person bringing suit. If any person use weights or measures not sealed, or which have been altered after having been sealed, whereby any one is defrauded in weight or measurement, he is liable to an action at law, in which the person defrauded may recover three times the amount of damages sustained. No apparatus used for weighing can be sealed which will not weigh accurately within one-fourth of a pound in one hundred.

KENTUCKY.—The county courts are required to keep standards verified by the standards of the State. Fees for testing steel-yard, balance, or beam, 25 cents; for weights and measures, 5 cents each. Penalty for using false weights or measures, $4 for each offense, and a like sum for every month the party may continue to keep the same.

Weight of coal, 76 pounds per bushel, except for "Wheeling," "Kentucky River," and "Cumberland," which are fixed, in their order respectively, at 84, 78, and 72 pounds per bushel.

OHIO.—The secretary of State acts as sealer, *ex officio*. Counties, incorporated towns, and cities are supplied with verified standards. These copies must be proved at least once in three years. Fees for sealing and marking a beam, 10 cents; weights, 5 cents each; liquid and dry measures, if one gallon or more, 10 cents; if less, 5 cents, with reasonable compensation for conforming to standards. All articles usually sold by heaped measure must be heaped in conical form as high as the articles to be measured will admit. Any person defrauded by the use of false weights and measures may maintain a civil suit against the offender, and, if judgment be rendered, shall receive double damages and costs of suit. The standard bushel for measuring stone, coal, and unslaked lime must contain 2,688 cubic inches. The laws concerning weights and measures are strictly enforced throughout the State.

MICHIGAN.—The half-bushel and its parts are the standard measures for fruits and other commodities sold by heaped measure, to be heaped as high as may be without special effort. The quantity known as a barrel of fruit, roots, or vegetables must be that quantity contained in a barrel made from staves 27 inches in length, and each head 16½ inches in diameter, or ordinary flour-barrel size. A box or basket of peaches must have the capacity of one-third of a bushel, struck measure. The laws concerning weights and measures are strictly enforced.

INDIANA.—Clerks of county courts are charged with the care of verified standards. For buying or selling any commodity by measures or weights not corresponding with standards of the county, the penalty for every offense is $20, with costs. Any person may apply to the clerk of the county court at any time, and have his weights and measures conformed to the standard.

ILLINOIS.—County sealers are required to compare the standards in their possession once in ten years with those of the State sealer. Fees for sealing beam, 6¼ cents; every weight, 2 cents; liquid and dry measures of the capacity of one gallon or more, 6¼ cents; if less than one gallon, 2 cents. If any person use weights, measures, or beams not conformed to standards, he is liable in five times the damages sustained by the purchaser. The law provides for the testing and correcting of cattle and large platform scales. This duty is charged upon county surveyors, who are entitled to a fee of $5 and reasonable charges for the transportation of the necessary apparatus for making tests. If any owner or keeper of cattle-scales or large platform scales use them for weighing purposes after they have been marked "condemned," he is liable for each offense to a fine of $100, one-half to the informer. If any person interested in the weight of any article is disposed to question the correctness of the scales, it is his right to demand a test to be made by the proper standards, the expense to be borne by the owner if they are found to be incorrect. In many counties of the State little if any attention is paid to the observance of the law, although nominally the same standards are recognized throughout the State.

WISCONSIN.—The treasurer of the State is, *ex officio*, State sealer of weights and measures. Every county is required to provide itself with weights, measures, scales, and beams, to be in exact conformity with the State standards. The treasurers of counties perform the duties of sealers. A fee of 5 cents is charged for the first sealing of every weight, measure, scale, or beam, and 3 cents for each subsequent sealing. The vibrating steelyard is allowed to be used, but

beam and poise must be annually tried, proved, and sealed by the proper officer. The half-bushel and its parts is the standard measure for fruits and other commodities customarily sold by heaped measure; and, in measuring such articles, the measure must be heaped as high as may be without special effort or design. The penalty for using false weights or measures is a fine not exceeding $500, or imprisonment in the county jail not more than one year.

MINNESOTA.—In Minnesota, the State treasurer acts as State sealer. County treasurers are supplied with standards, which must be tested once in five years. Townships may choose sealers, who must test standards once in two years. Fees, 5 cents for each weight and measure sealed. All measures by which meal, fruits, and other commodities are usually sold by heaped measure must be of the following dimensions: the bushel not less in its inside diameter than 18½ inches; the half-bushel not less than 13¾ inches; the peck not less than 10¾ inches; the half-peck not less than 9 inches—to be heaped as high as may be without special effort. All weights and measures must be tested once a year. Penalty for using false weights and measures, $20.

IOWA.—A superintendent of weights and measures is appointed by the governor from the faculty of the State University. The standards are preserved in a fire-proof building on the university grounds. Counties are provided with verified standards, which must be compared as often as once in ten years. County sealers are appointed by the board of supervisors. City and town councils may appoint sealers. Fees, for marking and sealing beam, 10 cents; weights, 5 cents each; liquid and dry measures, 5 cents each; and reasonable compensation for the conforming of all weights and measures to the standards. For using false weights and measures the penalty is $5 for each offense, the offending party being also liable to action at law, in which the person defrauded may recover treble damages and costs. Weights and measures must be tested once a year; the penalty for non-conformance being $5, recoverable by any person who may prosecute.

MISSOURI.—The clerks of county courts must supply themselves, at the expense of their respective counties, with standard weights and measures. The penalty for buying or selling by any other than the fixed standards is $10, recoverable before any justice of the peace of the county. The law is reported to be strictly enforced throughout the State.

KANSAS.—County clerks are charged with the care of standards. Cities may establish standard weights and measures, and regulate the weights and measures to be used in each respectively, and the weighing and measuring of all commodities in every case not otherwise provided for by law. Every city is also allowed to fix the fees of persons employed to weigh and inspect hay, grain, and coal. Penalty for buying or selling by false weights or measures, $10, recoverable by party injured. The law is reported to be strictly enforced throughout the State.

NEBRASKA.—Any one who knowingly uses false weights and measures is liable to a fine of not less than $5 nor more than $25, and is also liable in double the amount of damages sustained by the injured party. The fines recovered in such cases are appropriated to the use of common schools.

CALIFORNIA.—The secretary of State is, *ex-officio*, State sealer, and clerks of county courts act as county sealers. The latter must verify their standards once in five years. Fees, for marking and sealing beam, 75 cents; weights, each, 25 cents; liquid and dry measures,

one gallon, 40 cents; less than one gallon, 20 cents. Any person injured or defrauded by the use of false weights or measures may recover five-fold damages. The use of false weights or measures may also be deemed a misdemeanor, and, upon conviction, the offending party may be fined in any sum not exceeding $100. All commodities sold by heaped measure must be heaped in the form of a cone, as high as the articles measured will admit. By custom, almost everything in the way of agricultural products is sold by weight.

OREGON.—The State treasurer acts as State sealer. The half-bushel and its parts is made the standard measure for charcoal, fruits, and other commodities sold by heaped measure. For using false weights or measures, or for stamping false tare upon casks or packages, the penalty is imprisonment in the county jail for not less than one month nor more than one year, or fine of not less that $50 nor more than $500.

DISTRICT OF COLUMBIA.—The fees for testing scale-beams, weights, and measures, are for each 10 cents; double fees if rectified, branded, or sealed at any other place than the office of the sealer. The sealer, under penalty of $20 for neglect, is required at least once in six months, to enter every store, shop, market, or other place where goods are sold, and examine scales, weights, and measures. If any are found to be unsealed, or in any way false, they may be seized, and the owner is subject to a fine of $1 for each weight or measure ascertained to be not in accordance with the proper standards. Any person refusing to produce his scales, weights, or measures for inspection is liable to a fine of not less than $1 nor more than $10. For selling by false beams, weights, and measures, the fine is $1 for each offense. Steelyards not conforming to standard may be seized, the owner also incurring a penalty of $2. All hay and platform scales must be adjusted twice in each year. Fees, for ten tons, $2; for each additional ton, 25 cents. All weights and measures seized for non-conformity to standards may be adjusted and returned to owners. Spring-balance scales must be tested at least every three months, a card to be attached, or to be near at hand, attesting the examination. Penalty for non-compliance, $10; half to the informer. Persons offering to sell by dry measures not conformed to standards are liable to a fine of not less than $3 nor more than $5. The law is very strict in regard to the regulation of the scales, weights, and measures of the public markets.

The following tabular statement will show the weights of specified articles in the different States in the Union, as they obtain by law or usage:

Tabular statement showing the number of pounds per bushel required, by law or custom, in the sale of articles specified, in the several States of the Union.

States.																						SEEDS.									
	Apples, dried.	Barley.	Beans, castor.	Beans, white.	Bran.	Buckwheat.	Coal.	Corn, ear.	Corn, shelled.	Corn meal.	Hair.	Lime, unslaked.	Malt, barley.	Onions.	Oats.	Peaches, dried.	Potatoes, Irish.	Potatoes, sweet.	Peas.	Rye.	Salt.	Blue-grass.	Clover.	Flax.	Hemp.	Hungarian.	Millet.	Osageorange.	Sorghum.	Timothy.	Turnips.	Wheat.
Maine		48		64		48			56	50	11			52	30		60		60												50	60
New Hampshire				60					56	50					30		60		60	56												60
Vermont		48		64		48									32		60		60	56	70		60							42		60
Massachusetts		48				48			56	50				52	32		60			56												60
Rhode Island																																
Connecticut						45			56						28		60			56												56
New York		48		62		48			58						32		60		60	56			60	55						44		60
New Jersey		48				50			56						30		60			56			64	55								60
Pennsylvania		47				48			56						30		56			56	85		62									60
Delaware									56																							60
Maryland	28	48		62		48		70	56		7		34	57	32		60		60	56	56	14	64	56	44	48	50	37	37	45		60
District of Columbia	24	47	46	62	20	48		70	56	48	7		38	57	32	38	56	56	60	56	50	12	60	56	44					45	55	60
Virginia		48		60		48		70	56	50					32		60	56	60	56			64	56	44					45	56	60
West Virginia	25	48		60		52	80		56	48					32	33	60			56			60	56						45	60	60
North Carolina		48				50			54	46					30				50	56			64	55								60
South Carolina	26	48	46	60	20	56	80	70	56	50		80	38	57	33	33	60		60	56	50	14	60	56	44	60	50					60
Georgia	25	40	46				80		56	48				75	35		56	60			56		60	56						45		60
Alabama																																
Florida																																
Texas																																
Louisiana		32							56						32					32												60
Mississippi																																
Arkansas	24	48	46	60		52	80	70	56	50	8		34	57	32	33	60	50	46	56	50	14	60	56	44	48	50	36	42	45		60
Tennessee	26	48		60	20	50		70	56	50				56	32		60	50	60	56		14		56		48	50	33	42	45		60
Kentucky		48		60	20	52			56	50				57	33⅓		56			56	50	14	60	56	44					45		60
Ohio	25	48		60		50		70	56			70			32	33	60	50	60	56			60	56	44	50	50			45		60
Michigan	22	48	46	60		48	80	70	56			70		54	32	28	60	56	60	56	56	14	60	56	44	50	50	33		45	58	60
Indiana	25	48	46	60		50	70	68	56	50				48	32	33	60			56	50	14	60	56	44							60
Illinois	24	48	46	60	20	52		70	56	48	8	80	38	57	32	33	60	55		56	50	14	60	56	44							60
Wisconsin	28	48				50			56						32	28	60			56			60	56								60
Minnesota	28	48				42			56						32	28	60			56			60									60
Iowa	24	48	46	60	20	52			56			80		57	33	33	60	46		56	50	14	60	56	44	45	45	32	30	45		60
Missouri	24	48	46	60	20	52			56					57	32	33	60			56	50	14	60	56	44					45		60
Kansas	24	50	46	60	20	50		70	56	50	8	80	32	57	32		60	55		56	50	14		56	44	55	55			45	55	60
Nebraska	24	48	46	60	20	52		70	56	50	8	80	30	57	34	33	60	50	60	56	50	14	60	56	44	60	85	82	30	45	55	60
California		50				40			52						32					54												60
Oregon	28	46				42			56						36	28	60			56			60									60

CURRENT FACTS IN AGRICULTURE.

FERTILIZERS.

Improvident waste of manures.—Professor Orton, assistant State geologist of Ohio, after remarking on the futility of endeavoring to recuperate by means of clover alone a soil subjected to continuous cropping, says that fertilizing material, both of the barn-yard and from other sources, continues to be wasted in the most reckless manner. In Springfield and its immediate vicinity 10,000 cords of wood are burned annually in the manufacture of lime, and at other places great quantities. The ashes, mixed with lime refuse, can generally be had for the hauling, yet not one bushel in a thousand is applied on the farm; instead of this, the material is turned on vacant ground, or used for road-beds, or carted into the streams. Again, thousands of tons of bones are annually available for fertilizing purposes in Southwestern Ohio, but there is not a single establishment for their preparation in that region.

Publication of chemical analyses.—The council of the Royal Agricultural Society of England state that the quarterly reports of Dr. Voelcker, the consulting chemist, giving analyses of manures and feeding-stuffs, with names of the venders, are regularly published in the agricultural journals as well as in the journal of the society, and that this publication is found to serve a very excellent purpose, notwithstanding some dissatisfaction on the part of dealers whose articles have been analyzed. Dr. Voelcker states that, of the thirty-two samples of bone-dust analyzed from December, 1869, to December, 1870, not one was adulterated, which showed that the unsparing publication of the names and addresses of dealers in adulterated bone-dust had had a salutary effect. He reports a large adulteration in samples of feeding-cake.

Analyses of fertilizers.—Dr. J. R. Nichols, of Massachusetts, while strongly advocating attention to special fertilizers, advises farmers to ascertain the actual values of fertilizers offered for sale, as indicated by the accompanying statements of analyses. In illustration of the necessity of this precaution, he states that, in the case of a certain New Hampshire article obtained from grinding silicious rock, and recently put on the market at a high price, one item of the analysis published by the proprietors was "30 per cent. of silica" or sand. Another article of somewhat similar character was represented to contain about 91 per cent. of silica, and on this Dr. Nichols jocosely remarks that he has material on his own farm containing 93 per cent. of silica, which he is ready to supply to all comers at 25 cents per horse-load, and that he has found it to be excellent for application on swampy lands. In another case, a dealer has offered a compound priced at $27 per ton, with a statement of analysis representing percentages of "aqua and organic matter," oxide of calcium and sulphuric acid, the statement amounting practically to this, namely: That every 100 pounds of the fertilizer contains 10 pounds of moist muck, 45 pounds of gypsum or plaster, 22 pounds of salt, and 15 pounds of carbonate and phosphate of lime; the first cost of one ton, or 2,000 pounds of the fertilizer, being about $9.60.

Value of wood-ashes.—Dr. Nichols places the commercial value of a bushel or 50 pounds of mixed, unleached ashes of oak, pine, hickory, birch, and maple at 39 cents, and of a bushel of leached ashes at 9 cents. As regards their value for application on the land, he finds by his own experience that, when applied judiciously, according to the requirements of the soil, crops, &c., the unleached ashes will in most seasons return

a value in product of 60 cents to 70 cents per bushel the first year, and that the leached ashes will return 15 cents to 20 cents per bushel the first year, their influence on the soil continuing for a long time. He cautions purchasers against the gross frauds sometimes practiced when ashes are sold in large quantity. A sample of dry ashes, alleged to be from wood, and sold as such, had been brought to him, when analysis proved them to contain over 50 per cent. of coal-ashes. Again, a friend of his had purchased a schooner load of ashes brought from an eastern port, paying 25 cents per bushel; they proved to be worth only 5 cents per bushel, one-fourth part being a mixture of coal and wood ashes, the rest lime, sand, &c.

Large outlays for manures.—Tobacco growers at East Whately, Massachusetts, during the present year have shipped very large quantities of stable manure, by railroad, from Middlebury and Montpelier, and other points in Vermont, in some cases a distance of one hundred and fifty miles. The manure from the two former places cost $13 per cord, delivered on the field at East Whately, the cost of freight being $36 and $40 per car load. Considerable amounts were also received from Whitehall, New York, and points in Massachusetts. During the spring, from $20,000 to $25,000 were paid out in that neighborhood for guano, phosphate, plaster, lime, &c.

City street sweepings.—A chemical analysis of street-dust obtained at different points in Boston showed it to be practically worthless for manure. The experience of gardeners near New-York gives similar testimony in respect to the street dust of that city.

Southern trade in fertilizers.—Dr. Means, inspector of fertilizers in Georgia, estimates that the people of that State annually pay ten millions of dollars for fertilizers, mostly to parties out of the State.

CORN.

Cost of raising corn.—Dr. George D. Pearcy, of Knightstown, Indiana, reports a crop of corn made in 1870 on 20 acres of deep, dark, alluvial soil, well drained and deeply tilled, which, without manure, averaged 60 bushels per acre, amounting to 1,200 bushels, worth 50 cents per bushel. Adding $20 for value of pasturage after taking off the corn, the total receipts were $620. The expense account was as follows: Plowing, ten days' work, $30; harrowing, three days, $9; three bushels of seed corn, $2.25; drilling in corn, three days, $4.50; rolling after planting, three days, $9; replanting, two days, $2; plowing, four times, five days' work at each time, at $1.50 per day, $30; husking and cribbing, $40; interest on land, $120; making the total expense $246.75, or very nearly 20 3-5 cents per bushel, and leaving a profit of $373.25, or $18.66 per acre. Wheat was then sown on the same ground, and was harvested July 5 and 6, 1871, yielding 400 bushels, worth $1.50 per bushel. Allowing one-half for cultivation, the crop netted $300, making a total profit of $673.25 on corn and wheat for fourteen months, (virtually two years,) an average of $33.66 per acre.

Mr. O. Burras, of North Fairfield, Ohio, cultivating in corn an area of a little more than nine acres of sandy loam, reports the cost per acre of seed, cultivation, and harvesting at $13.83, no allowance being made for manure; interest on investment in land, $4.67; taxes and wear of tools, 39 cents—total expense per acre, $18.89, showing, with a crop of 84⅔ bushels per acre, a cost of 22⅓ cents per bushel. The corn was worth 47⅚ cents per bushel, and, including fodder and pumpkins, the profit per acre was $31.29. Recent statements by Mr. J. C. Burroughs, of Illinois, show, for twenty acres, 27 cents per bushel as the cost of raising

corn; by Mr. J. P. Thomas, of Chester County, Pennsylvania, 25½ cents per bushel upon a yield of 90 bushels of shelled corn per acre, without allowance for manure; by Mr. L. M. Rogers, of Oneida Lake, New York, for a crop of 50 bushels on one acre, a cost of $22.50, including rent of land, making a cost of 45 cents per bushel. Profit, at a price of 85 cents per bushel, $20 per acre.

Variation in yearly averages.—In the Maumee Valley, in the northwestern part of Ohio, the average yield of corn per acre, in 1868, was 30.22 bushels; in 1869, 17.57 bushels; in 1870, 39.65 bushels.

LIVE STOCK.

Improved stock cars.—The first train of "palace" stock cars from the West to the East passed over the Pennsylvania Railroad and its western connections about the 1st of May, and consisted of eleven cars, containing 172 head of cattle. The cars are arranged for sixteen head each, with separate stalls connected by gates, and bedded with shavings. The cars are so constructed that the cattle can be fed and watered during the transit without unshipping. Ninety-six hours from Saint Louis to New York is stated to be the time attainable by stock trains of this description. Under the old arrangements ten days were often consumed in making the trip; and the discomfort to cattle and the shrinkage in their weight were serious.

Sale of Berkshire hogs.—A company of gentlemen residing in Scott County, Kentucky, known as the Scott County Importing Company, some time ago sent an agent to England, who purchased a number of the finest Berkshire hogs to be found in the best herds of that country. The sale of this stock took place July 13, at the farm of Mr. Barbee, near Georgetown, and attracted a large attendance. Eighteen animals were sold at an average of $171 each. One sow sold for $510, another for $335, and another for $300. The lowest figures for a sow were $65. The highest price for a boar was $160, and the lowest $80.

Improvement of English beef stock.—In the Massachusetts agricultural report for 1870 is a statement, founded upon a Parliamentary report, of the average weight of beef-cattle at Smithfield market, England, at the periods named: 1732, 370 pounds; 1795, 462 pounds; 1825, 656 pounds, with a gain of about one year in the preparation for market, the animal being considered ripe for the butcher at four years of age instead of five.

Losses by disease in England.—According to tabular estimates appearing in Morton's Almanac, the loss from lung disease, and foot and mouth disease, among cattle in England, for the last thirty years, has amounted to 5,549,780 head, valued at $418,084,270.

Abortion in France.—Recent French veterinary statements are to the effect that in France 14 per cent. of the cows slip their calves, imported and unacclimated stock being most subject to abortion.

Premium hogs.—At the exposition of swine at Chicago, Illinois, in September, the following prizes were taken for best displays of hogs of one breed, the number in each case being not less than ten nor more than twenty: To S. H. Clay & Co., Paris, Kentucky, $1,000; John B. Craig, Edmonton, Canada, $500; Edmund Terrill, Clayton, Illinois, $250; H. M. & W. P. Sisson, Galesburgh, Illinois, $250.

THE DAIRY.

An Iowa milk farm.—The farm of William Patrick, near Des Moines, Iowa, consists of 235 acres of prairie and timber land, and is chiefly devoted to the business of supplying milk to the citizens of Des Moines.

Mr. Patrick milks from forty to forty-five cows, and delivers once a day in winter and twice a day in summer, selling also a few pounds of butter daily. In winter he feeds to each cow twelve quarts of bran and shorts, mixed, per day, with a sufficiency of good prairie-hay; in the summer twelve quarts of bran per day, in addition to pasture. The expense of feeding in winter is 20 cents per head daily. An account kept in January and February, 1870, of the gross receipts per head gave an exhibit of $14.50 for the former month and $12.50 for the latter, not including a liberal supply of milk and butter for the family. Mr. Patrick's herd is chiefly formed by selection from common stock, and his experience is that a good milch cow, worth $100, will pay for her self and keep in one year. The building in which the cows are fed and milked is 80 feet by 36. The cows are secured in their places by confining their heads with sliding stanchions. Inclined floors carry the droppings into conductors, which extend the whole length of the building. Cows failing to show a good yield of milk are fattened for the butcher, the selections from the herd for such purpose averaging ten per cent. yearly. Five hands are employed on the farm, and, in addition to dairy operations, a considerable business is done in raising beeves and hogs.

Adulterated milk.—A man named Whipple, of Shrewsbury, Massachusetts, was recently arrested for manufacturing and selling adulterated milk, having carried on the business for some time. He had fitted up a room in Worcester with a tank of 180 gallons in capacity, which he filled with milk, combined with a mixture of burned molasses, chalk, salt, and water, in the proportion of 40 gallons of the molasses mixture to 140 gallons of milk. The whole was then sold as pure country milk.

Swiss dairymen in California.—San Francisco papers state that there are nearly six hundred Swiss engaged in dairying in Marion County, and that as a general rule they commenced poor, but have made large profits.

FRUIT, ETC.

Grapes and wine in Iowa.—In 1870, Des Moines County, Southeastern Iowa, contained sixty vineyards, aggregating 250 acres, averaging 1,200 vines to the acre, and showing a total of 300,000 vines. Of these about one-half were Concord, the remainder being Catawbas and a few other varieties. The product of grapes averaged three pounds to the vine, amounting to 900,000 pounds. The estimated yield from 40 acres in gardens swelled the total of grapes to 1,100,000 pounds. Of these 400,000 pounds were manufactured into wine, making 30,000 gallons, worth, at $1.35 per gallon, $40,500; 700,000 pounds were marketed as fruit, bringing, at 6 cents per pound, $42,000; the united value of the grapes and wine being $82,500.

In Scott County, in the eastern part of the State, Mr. George L. Davenport's Clifton vineyard had 6,000 bearing vines, and turned out 2,000 gallons of wine. At Black Hawk vineyards, owned by Messrs. A. J. F. Schmidt, 9,000 gallons of wine were made, consuming over 100,000 pounds of grapes.

Grape product of Ohio.—The statistical report of the secretary of state of Ohio shows that the grape crop of that State for 1870 was 15,853,719 pounds, being nearly equal to the total of the five previous years.

Wine in Southeastern Michigan.—Mr. Thomas Whelpley, of Monroe, Michigan, in a recent letter to the Department, says: "The mouth of the river Raisin, this day, rivals the famous Rhine in Germany in richness and luxuriance of vintage. The six miles square, including the city of

Monroe, turned out last year 16,000 gallons of wine that is actually displacing the German Rhine wine in our midst, and the vintage of this year promises to be double that of last."

Preservation of grapes.—In the process introduced by M. Tremellat, of Marseilles, and used on a large scale in Paris and elsewhere, bunches of grapes are cut in such a manner as to leave with them a considerable portion of the adjacent woody part of the vine, and are then suspended over a vessel filled with water, so that while hanging near the surface of the water the ends of the stems are immersed. As the moisture evaporates from the grapes, it is restored by capillary absorption through the stem, and no change takes place. By this method grapes are kept from one year over into another, as fresh and fair as at the moment of gathering.

Reduction in prices of grapes.—At a late horticultural discussion at Saint Louis, Missouri, Dr. Spaulding said that first-class grapes were then selling at wholesale for 3½ cents per pound, making a loss to the producer. Fifteen years ago, he had said at a meeting of a horticultural society in the same city, that grapes, then selling at 25 cents per pound, would within twenty years be sold at 5 cents, and his assertion was laughed at.

Prices of fine pears.—At a meeting of the Western New York Horticultural Society, in the early part of the year, Mr. J. H. Babcock stated that a neighbor had sold Anjou pears for two years at $20 per barrel; they were bought by men in Boston, and were resold in that city at $34 per barrel. He did not know at what price they were retailed. Mr. T. G. Yeomans, of Walworth, said that his Duchesse d'Angoulêmes did not do as well as usual the past season, and sold as low as $20 and $22 per barrel. Mr. Oliver Chapin stated that he had sold his Bartletts at an average of $9 per barrel, and that a neighbor selected a barrel of Bartletts from a large crop, sold it at $50, and they were afterward retailed at $1 each.

Peach baskets in Southwestern Michigan.—At Benton Harbor, by one firm, 300,000 peach baskets were manufactured, and 60,000 by another; at Saint Joseph, 160,000 were made; at Dowagiac, 150,000; at another point, 80,000; there were also other large numbers manufactured in different localities, of which no account is presented.

Receipts of peaches in New York.—It is stated that during the week ending August 12, 1871, the New Jersey Railroad alone brought into New York City 100,000 baskets of peaches daily, employing nine trains, or a total of 196 cars.

Blackberry culture in Ohio.—Mr. N. Ohmer, of Dayton, Ohio, in a letter of November 27, 1871, states that he has three acres of blackberries in bearing, and from these obtains a net profit of $250 per acre. He grows the Wilson and the Kittatinny, but prefers the latter, and last spring planted five acres of this variety. He plants at distances of four feet, in rows eight feet apart, training to a No. 12 annealed wire attached to posts standing three feet above ground, at distances of thirty feet. The canes are cut at a height of four feet, and this is deemed quite important in order to insure a profitable crop. He gives thorough but shallow culture annually, in spring and early summer; never at a late period in the season.

Blackberries in Indiana.—During the season of 1870, Mr. A. B. Pegg, of Terre Haute, Indiana, obtained 70 bushels of Lawton blackberries per acre from three acres, paying 1¾ cents per quart for picking, and marketing at 12½ cents per quart. His gross returns amounted to $722.40, or

$240.80 per acre, after deducting the cost of picking. His expense of culture did not exceed $10 for the three acres.

The rotting of fruit.—According to Decaisne, the rotting of fruit is produced by two microscopic fungi, which develop in moist, confined air, viz, *Mucor mucedo* and *Penicillium glaucum*, infinitely minute germs of which are continually floating in the atmosphere, and which attack more especially any injured or abraded portion of the surface. If the fruit be wrapped up in cotton, or with soft tissue paper, or, still better, with waxed paper or tin foil, the introduction of these germs will be prevented, and the fruit can be kept for a long time without any appreciable change.

Orange trade in California.—The San Francisco Commercial Herald states that in 1871 twenty-nine vessels arrived at that port from Tahiti with 5,120,000 oranges and 106,000 cocoa-nuts, and 500,000 oranges were received from Mexican ports; also a few from Hawaii. There were received from Los Angeles County, for the season from December to June, 1,535,000 oranges and 228,000 lemons, besides pomegranates, citron, walnuts, &c.

TREES AND TIMBER.

A western tree nursery.—In 1869 the *ad-interim* committee of the Illinois State Horticultural Society visited the nursery of R. Douglas & Son, at Waukegan, Illinois, and reported that they found there 15,000,000 evergreens and European larches. At a meeting of the Eastern Iowa Horticultural Society, in June of the following year, Mr. Douglas, in reply to inquiries then made, estimated the number of evergreens and European larches, two to three years old, transplanted, at 1,000,000; not transplanted, in the seed-bed, one and two years old, 20,000,000.

Removal of forests.—Mr. J. H. Tice, in an address before the Missouri State Horticultural Society, refers the increasing aridity of a large region bordering on the Mississippi to the destruction of forests and denudation of prairies along tributaries of that great river. He recapitulates the testimony of William C. Bryant, who, speaking especially of Eastern Ohio, says that it is a common observation that the summers are becoming drier and the streams smaller, several rivers showing a considerable decrease in navigability during the last fifty years. The summers are hotter and the winters are colder.

The Eucalyptus.—The supposition that the Australian *Eucalypti* and *Acaciæ* are peculiarly adapted to our dry western plains is a mistaken one. These regions differ greatly in conditions of season from the actual habitat of the *Eucalypti*, the Australian growing season being quite wet, although followed by a dry term. Finally, these trees are unable to resist any considerable frosts, and do not flourish east of the Pacific coast regions.

Timber for naval purposes.—The secretary of the Iowa Board of Agriculture states, that within a few months one man alone has contracted to furnish the British government with 5,000,000 cubic feet of white oak, which will be cut from forests within fifty miles of Cairo, Illinois.

Sale of trees in Indiana.—John T. Matlock, of Danville, Indiana, recently sold one hundred trees, chiefly poplars, to a lumberman of that place, for $2,450, averaging $24.50 each.

Errors in pruning.—Mr. D. W. Adams, secretary of the Iowa State Horticultural Society, expresses the opinion that in Northern Iowa more trees have been destroyed by improper pruning than by the inclemency of winter. Regional peculiarities must govern the treatment of trees.

In a country of humid climate, having mild winters, the top of the tree should be kept open, to let in sunlight and rain. In Northern Iowa, a region of great extremes of heat and cold, and searching winds, the tree should retain its natural defense of a close growth of wood and leaves.

MISCELLANEOUS.

Results of agricultural investigation.—When, from 1836 to 1840, Henry Colman (at a later date widely known by his work on European agriculture) was employed by the Massachusetts authorities in making an agricultural survey of that State, considerable doubt was expressed by many of the people as to the practical value of his undertaking, and it was at last suspended for want of an appropriation by the legislature. In his last report Mr. Colman showed that the expense to the people had averaged about one cent for each inhabitant of Massachusetts, while one of its best-informed citizens claimed that the survey had already repaid thirty-fold its cost in the improved agriculture of the State.

Indian Department of Agriculture.—A department of agriculture, revenue, and commerce has been created in British India, to take official cognizance of the following subjects: Land revenue and settlements; advances for works of agricultural improvement; agricultural and horticulture; fibers and silk; studs and cattle-breeding; cattle disease; forestry; meteorology; commerce and trade; customs, sea and inland; opium; salt; excise; stamps; minerals and geological survey; fisheries; industrial arts; museums; exhibitions; statistics; gazetteers; weights and measures; census; surveys, revenue, topographical, and trigonometrical.

Wasteful management.—A correspondent of the Southern Cultivator concludes, from observations made during travel in Northwestern Georgia, that quite 25 per cent. of the farm products of that region are either left ungathered or are wasted when gathered. Corn is allowed to stand five or six weeks after it is fit to be harvested; bad fences admit the depredations of stock; the corn is shucked in a wasteful fashion; there is a deficiency of proper storage for harvested crops, and corn, wheat, and straw are destroyed by vermin. In addition to all this, the corn is fed out in a shiftless, hap-hazard way, and the consequence is that while all farm products command good prices, the producer realizes a small net profit.

Impoverishment of soils.—Professor Orton, of Ohio, illustrating the gradual impoverishment of the soils of this country, gives a striking example in the case of Southwestern Ohio. This region, originally of remarkable fertility, now has large areas of upland where the soil, possessing less depth, and being less easily worked than that of the valleys, has so far deteriorated that the average product of wheat is less than 10 bushels per acre—an unremunerative crop. A frequent recurrence of failure in staple crops is mainly attributed to this depreciation of land. The largest corn tract of this district lies at the mouth of the Miami River, and intelligent farmers who have resided on it for forty years state that during that period the average yield of corn has fallen from 75 bushels to less than 40 bushels per acre.

Cost of raising cotton.—The average of three estimates by Messrs. E. M. Pendleton, of Sparta, Georgia, and T. M. Turner, puts the cost of producing cotton on a farm of 500 acres, worth $8 per acre, at 11$\frac{7}{16}$ cents per pound. The cost of eight mules, at $175 each, and the necessary farm implements, are reckoned in the investment. The current expense

account includes interest on the value of the land, and the outlay for labor, repairs, insurance, and guano. The estimates cover both the tenant or share system, and labor for wages. Corn, oats, &c., are supposed to be grown on the place in sufficient quantity for feed, nothing being sold but the lint cotton, the area kept in cotton ranging from 128 acres to 150 acres, with a production of 200 pounds of lint cotton per acre. This estimate is stated to represent fairly the cost of production in Hancock County, Georgia, under the indicated conditions.

Alfalfa in Southern California.—San Bernardino Valley, California, is over fifty miles long and nearly thirty miles wide, and is fertilized by numerous streams which flow from the surrounding mountain ranges. In this valley the alfalfa, growing perennially, gives eight cuttings per year, of fine quality, though extensive fields lie unmolested year after year. Immense herds of cattle are fattened, and the beef is superior to that of any other part of the State, while the hay is in great demand, and brings an extra price in the market.

Wheat in California.—Mr. Rafael Pinto, of Watsonville, California, states that in 1871 he raised 800 centals of wheat on 14½ acres—an average of 92 bushels per acre—and that many acres in Pajaro Valley gave a much larger yield. Two acres, cultivated by Mr. Daniel Tuttle, of Watsonville, produced 12,360 pounds English club wheat, or 103 bushels per acre, which was sold on the ground, without sacks, at 2½ cents per pound, returning $154.50 per acre.

Productiveness of tule land.—The San Francisco Commercial Herald, in an account of a wheat crop grown at Twichell's Island, California, on 500 acres of partially reclaimed tule land, states that the tule was burned over, and the wheat sown in the ashes and trampled in by sheep, neither plow nor harrow being used in preparing the land. An average crop of 20 sacks, or 45 bushels per acre, was obtained, the total amounting to 22,500 bushels, worth $30,000. After the wheat was harvested, the flood-gates were opened, and the land irrigated, the result being that a volunteer crop was obtained sufficient to make three tons of good hay per acre, and worth nearly as much as the grain crop.

The trans-continental tea trade.—At date of August 13, 1871, the steamer Japan brought from China and Japan to San Francisco, in addition to 1,025 packages of silk and 1,663 of assorted merchandise, 48,821 packages of teas, being much the largest single importation of teas that ever entered an American port. Of this quantity, 29,735 packages were for New York, 2,092 for Boston, 263 for Philadelphia, 135 for Cincinnati, and 4,599 for Chicago, making a total of 36,824 packages for the Atlantic and Western markets. The San Francisco Commercial Herald of August 18 stated that 30,000 tons of teas, silks, &c., were awaiting shipment to America from Asiatic ports, at the time of the sailing of the Japan, the greater part of which would probably come to that city.

Adulteration of tea.—So extensively is this now carried on in China, that Mr. Medhurst, the British consul at Shanghai, recently wrote that 53,000 pounds of willow leaves were in course of manipulation at one port alone, to be mixed with tea for shipment, at the ratio of from 10 to 20 per cent. The trade in these willow leaves (which cost about 4 cents a pound) is openly carried on, and not the slightest attempt is made to disguise the object for which they are prepared.

Accidental prize crops.—The secretary of the Ohio State Board of Agriculture states that all the premiums paid by the State society up to the present time have been on accidental crops. Some time ago Messrs. DeWitt & Co., manufacturers of reapers and mowers, placed at the dis-

posal of the board a reaping-machine worth $150, to be awarded to that person who should grow 40 bushels of wheat per acre, having filed notice at the time of sowing the wheat, with a statement of the method of preparation of the soil, and other prescribed particulars. Some preliminary statements were filed, but the prize was never taken.

Wheat in South Carolina.—Mr. A. M. Latham, of Ashley Barony, South Carolina, states that, on 7 acres of old field, he plowed 9 inches deep, turning under a luxuriant crop of weeds, and sowed one bushel of wheat per acre. The crop attained about 5 feet in height, yielding 367 bushels of fine wheat, or $52\frac{3}{7}$ bushels per acre.

Wheat supply of Great Britain.—Mr. Lawes, the English agricultural statistician, estimates that Great Britain will require for the year ending September 1, 1872, a supply of wheat from foreign sources amounting to more than 46,000,000 bushels.

American reapers in Hungary.—An American reaping machine won the prize in the competition instituted by the government of Central Hungary, in the summer of the current year, near the town of Guyazyos. Between thirty-five and forty American and European first class machines were entered, and the prize—100 ducats and a gold medal—was awarded after several trials. The requirements embraced adaptation to the heavy grain crops of the country in combination with easy draught, &c.

Depth for planting seed.—No rules of universal application can be given as to the proper depth at which seed can be planted. In dry, sandy soils, situated in dry climates, a deeper covering is required than would be judicious under opposite conditions. For example, it has been shown that peas continue longer in bearing condition, on sandy soils, when sown at a depth of six inches than they do when placed nearer the surface; and it is said that the Indians upon the table-lands of the Colorado plant corn ten to twelve inches below the surface, with the best results; but, if planted with only one or two inches of covering, the crop fails. Seeds also vary in their ability to penetrate depths of soil in germinating. Leguminous seeds, and some of the largest seeding gramineæ can be planted deeper than those of a lighter character.

Influence of variations of temperature on plant growth.—In a paper lately published by Köppen, on the relation of conditions of heat to the phenomena of growth in plants, the conclusion is reached that variations of temperature are in all cases prejudicial to the growth of the germ, even when amounting to a few degrees only, the germination proceeding more rapidly at a low but uniform temperature than at a higher one subject to variation. A nearly uniform spring temperature with a cloudy sky, is indicated as more favorable to rapid development of vegetation than an alternation of hot days and cool nights, the mean temperature in each case being the same.

Absorbent power of soils.—By this term, when used in agricultural practice, is generally understood that peculiarity of the soil which causes it, while acting as a filter for solutions received on its surface, to seize and hold the plant food which was passing in these solutions. The absorbing power of the soil appears to be in direct proportion to its adhesiveness; and as sandy soils possess the latter quality in a less degree than clays, the manures applied to them pass off more readily, to the injury of vegetation. This fact has been acted upon for a long time, since it is the practice to apply a slight but oft repeated manuring to sandy soils, while with the heavier soils the reverse may be the case.

Preventing the germination of potatoes in cellars.—Much trouble is experienced by farmers and others, who have occasion to store potatoes for a

considerable length of time, in preventing their germination, and consequent depreciation in value as food. Experiments prosecuted in Germany have shown that this can be accomplished by exposing the potatoes to the vapor of sulphurous acid, by any of the various well-known modes, and a large mass of potatoes can be treated at one time. This process, if not entirely effective in accomplishing the object, will retard or modify the sprouting of the potato to such an extent as to render the injury caused thereby very slight. The flavor of the potato is not affected in the least by this treatment, nor is its vitality diminished; the action being simply to retard or prevent the formation and growth of the eyes.

Destroying mold in cellars.—According to Dr. Wiedehold, fungus growths in cellars may be combated either by burning sulphur or by pouring two parts of concentrated sulphuric acid over one part of common salt. In the first instance, sulphurous acid gas is produced; and in the second, hydrochloric acid, by means of which the fungi are destroyed. During the process all openings must be closed, so as to prevent any escape of the gas, and the greatest care exercised not to enter the cellar after the operation until it has been thoroughly ventilated.

New habits of insects.—Professor C. V. Riley, the Missouri State entomologist, in his report for 1870, illustrates the tendency of insects to acquire new habits of feeding, by the fact that the glassy-winged soldier-bug, (*Campyloneura vitripennis*, Say,) which commonly has been found on different kinds of oak, appeared in large numbers in the vineyard of Dr. C. W. Spaulding, at Rose Hill, Missouri, in September of that year, committing great destruction among the leaf-hoppers, a class of insects very troublesome to grape-growers. So far as Mr. Riley's knowledge extends, this "glassy soldier-bug," occurring sparingly throughout the country in the native timber, has been found only in cultivated vineyards within a limited district; but there is a strong probability that its new field of operation will become greatly enlarged.

Loss by insect ravages.—An estimate made some time ago by the president of the Missouri State Horticultural Society placed the annual loss in that State from insect depredations at $60,000,000.

Repelling potato bugs.—A gentleman near Chicago states that, taking finely pulverized, air-slaked lime, he commences in the morning at one end of his potato field, and scatters the lime over a section about ten rods wide. In the course of the day nearly all the bugs remove further down the field, and so on, until the bugs are brought on a small area, when they are destroyed by Paris green or other means.

The Faribault Republican, Minnesota, states that a gentleman in that neighborhood cleared his potato-patch of bugs by means of starving his hens from one to two days, when they began to consume the bugs, afterward continuing to follow them up.

A soda lake.—Journalists report the discovery of a "soda lake," one and one-half miles in circumference, in Wyoming Territory, a mile east of Independence Rock, and sixty-five miles from Rawlins, on the Union Pacific Railroad. It is estimated that 60,000 tons of sal soda can be manufactured from its waters annually, at a cost of not more than $2 per ton, and that the freight to the railroad would be about $12 per ton.

Preserving meat.—The British Medical Journal states that a new and very economical method of preserving meat has been introduced by an engineer of considerable experience in hot latitudes, the process being that of mechanical dessication by pressing the juice from the fiber. The juice is subjected to evaporation in vacuum, and both the meat and the juice thus treated are found to be very rich in food elements. This

method is to be practiced on an extensive scale at the Estancia Nueva Alemania, on the Rio de la Plata.

Importation of preserved meat.—English journals state that, in 1870, the imports of Australian preserved meat into that country reached the amount of £200,000, against about £80,000 in 1869, and £321 in 1866, which was the first year in which any satisfactory shipments were made.

Increased consumption of mutton.—Statements of Chicago live stock men go to show that the consumption of mutton in Chicago and vicinity is increasing in a greater ratio than the population.

A remunerative exhibition.—More than £2,500 were received for fees of admission to the exhibition of the London Horticultural Society, at Nottingham, England, from June 27 to July 1, 1871.

Hedges in Iowa.—The secretary of the Iowa Horticultural Society states that experience has fully proved that the Osage orange is unreliable as a durable hedge, north of Burlington, (40° 48′ north latitude,) being killed down, even after a few years of favorable growth, by the violence of the winters. The honey locust (*Gleditschia triacanthos*) is recommended in its place, being an approved hedge-plant, hardy and well adapted to northern regions.

Weather prediction.—In December, 1871, in consequence of a bulletin of the Signal-Service Bureau, stating the approach of a violent storm, Mr. S. C. Hastings, of San Francisco, California, telegraphed to his son, in charge of a large amount of stock pastured on tule land at Maine Prairie, to remove the stock at once to the high land, on account of the impending tempest. The order was obeyed, and a short time after the men had completed the removal, the Sacramento broke over its banks and flooded the land to the depth of five or six feet.

RECENT FARM EXPERIMENTS.

Two purposes are sought in these continued collections of experimental statements, purposes differing somewhat in character, yet tending to the same general end: first, to present such American and foreign experimental reports received at this Office as are most practically valuable to American agriculture; secondly, to give examples of experiments by individual farmers. This latter class of experiments, though not possessing the authority of costly scientific trials, have yet a cumulative value, and are doing much to enlighten and improve agricultural practice.

There has been a marked improvement observable during two or three years past in the character of experimental statements appearing in the agricultural publications of the country, and a growing appreciation of the importance of such trials, a juster conception of the best methods of conducting them, and a greater disposition to exactness in reporting results, attendant conditions of soil, climate, previous management of the field, prices of labor, manures, and products, and all other details necessary to a full understanding of the case.

American experimenters, whether distinctively scientific or otherwise, need especially to guard against too great diffusion of effort. Investigations should be concentrated on a small number of the most vital points of practice, and these researches should be thoroughly and persistently pressed. The partial failures of the past few years have led us to appreciate the force of those words of Dr. Voelcker, the English agricultural scientist: "Experiments should be made as simple as possible.

The great fault is that most of them attempt too much. Let experiments be made to embrace as few points as possible."

CORN.

Experiments in Southeastern Pennsylvania.—The two following statements of experiments with corn have been forwarded to the Department from the Brandywine Farmers' Club, Chester County, Pennsylvania. Mr. John S. Hope, who received a premium from the club for the best four acres of corn, states that this premium piece formed part of a field containing about twelve acres of elevated land, a loam of great natural fertility, which had been pastured uninterruptedly for more than forty years up to 1860. It was then limed, and in the following year plowed to the depth of eight inches, and planted in corn, making a large yield. This was followed by the usual rotation of oats, wheat, and grass; after which it was mowed for three successive years, and then pastured until the fall of 1870, by which time it had gained a heavy sod of grass. About April 1, 1871, it was covered with a light coat of barn-yard manure; it was plowed May 1 seven or eight inches deep, and well harrowed; it was then marked for hills four feet apart each way, and planted May 10 to May 15 with a mixture of large and small red cob gourd seed varieties. After the corn came up, it was worked three or four times with the cultivator up to June 20, when it was thinned to three stalks in the hill. It was cut and shocked in the latter part of September, and cribbed about November 1. Ten acres averaged 100 bushels per acre, four acres of this area reaching about 120 bushels each. Mr. Hope's experience leads him to the conclusion that the best course to obtain the largest product of corn, and at the same time to secure the improvement of the land at a comparatively small cost, is to cover the field one year before plowing with a heavy coat of barn-yard manure, plowing in the spring just before planting, and at the last working of the corn sowing clover seed. In the fall of the succeeding year plow down the clover for wheat, omitting the oats rotation.

The second statement is that of Mr. Charles L. Cook, to whom was awarded the prize for the best one acre of corn. His crop of 1869 was corn followed by grass. For the corn crop of 1871 the land was dressed lightly with barn-yard manure, and received 150 pounds of phosphate per acre, applied by drill, and also $12 worth of ligaments from bones. Some benefit was derived from an application of phosphate made two years before. The corn was planted May 15, at distances of three and four feet apart. The crop, after being cultivated four times, and hoed for the last working, yielded 115 bushels of shelled corn per acre.

Superphosphate and ashes on corn.—The following is an abstract of a statement made by J. C. and R. Jaques to the Essex County (Massachusetts) Agricultural Society: One acre was measured off, the soil a light loam, which had not been in corn for six years previous to the time of experiment. It was plowed late in the fall, and again in spring, about eight inches deep, and nine cords of manure applied—five cords plowed in and four harrowed in. Rows were marked 3½ feet each way, and three plots, equal in conditions of soil and situation, were set apart for special purposes of experiment. Plot 1, containing eight rows, of one hundred hills each, being in all not quite one-quarter of an acre, received 50 pounds of Bradley's superphosphate applied in the hills, one ounce in each hill. Plot 2, of the same size, received no other application than the general dressing given to the whole acre. Plot 3, containing six rows, of one hundred hills each, received $4\frac{11}{16}$ bushels of wood-ashes, one-half of a pint being put in each hill. The planting was done May

10. The entire acre yielded 100 bushels of shelled corn, valued at $1.10 per bushel, making $110, besides a very valuable product of fodder. Plot 1, receiving superphosphate at the rate of 222 pounds per acre, showed a gain over plot 2 of 10 bushels of corn to the acre, the fertilizer thus returning a value of 5 cents per pound. Plot 3, receiving ashes at the rate of $28\frac{9}{10}$ bushels per acre, gave a gain over plot 2 of $7\frac{2}{5}$ bushels of corn per acre, the ashes thus returning a value of 28 cents per bushel.

Insufficient nutrition.—The following illustrates the error of applying a fertilizer of stimulating character, without having provided a sufficient amount of nutritious material to give it proper support in forwarding the crop. A farmer in Millington, Massachusetts, states that two fields in his neighborhood, of very similar character, the soil a warm sandy loam, had both been severely cropped and brought into a low condition. These fields were well plowed and laid out for corn. One of them, having rather the thinnest and poorest soil, received in each hill a shovelful of compost of loam, with horse, cow, and pig manure mixed, and also a small handful of ashes, at planting, on May 10. In the other field each hill received a handful of superphosphate—one-half in the hill at planting, the other half put around the corn at the first hoeing. The product of the first-mentioned field was 93 bushels of plump, sound corn to the acre. On the other field the corn grew finely until about the time it was well set for ears, when it began to turn sickly, showing that the strength of the superphosphate had been exhausted, and, though there was a fair amount of stover, the crop proved almost a failure in respect of grain.

Comparison of varieties.—Professor Daniells's report of experiments made in 1871, on the experimental farm of the University of Wisconsin, contains the following table, showing the results obtained in a trial with five varieties of corn, planted May 12, in hills marked at distances of $3\frac{1}{2}$ feet each way, with three grains to the hill. The field had a southern exposure, and the cultivation was similar throughout. In stating the yield, 75 pounds of ears, weighed at the time of drawing the corn from the field, are taken as equal to a bushel of merchantable shelled corn.

Varieties.	Time of first ripe ears.	Time of harvesting.	Bushels per acre.
Early Dent	August 5	August 25	49.58
Dutton	August 11	August 25	47.12
Sanford	September 5	September 5	45.69
Cherokee	August 28	September 5	56.58
White Australian	August 17		72.49

In another experiment seven varieties were planted May 16, in hills four feet by four, with three grains to the hill, on a steep northern exposure. The following is the yield per acre, of each variety, stated in the order of ripening: Early Yellow Pop, harvested July 15, 9.24 bushels; Dutton, August 26, 31.53 bushels; Blue Australian, August 27, 36.43 bushels; White Australian, August 31, 44 bushels; Pearl Pop, September 15, 37.32 bushels; Joint Pop, September 15, 14.62 bushels; Sanford, September 27, 32.23 bushels. As to the White Australian, pre-eminent for productiveness in these experiments, the "Transactions of the Agricultural Society of Colorado for 1868" states that this, a new variety of flint corn, was brought to Colorado from Salt Lake, about two years before, and that, according to current report, it originally came from Australia, and is peculiarly adapted to high, dry climates. Seed taken from Colorado to Northern Illinois, in 1870, ripened in ninety-six

days. Professor Daniells states that it presents the indications of a new variety, its characteristics not yet fixed. Some of it is eight-rowed, and some twelve-rowed. It is a very soft corn, its kernels husking more easily than those of the common Yellow Dent. The Blue Australian is the product of bluish kernels selected from the White Australian.

Time of saving seed.—Another experiment was continued from 1869, in which year seed was selected from the earliest ripening ears of Dent corn, other seed being taken in the ordinary method, at time of husking. These selections of seed were planted in 1870, on adjacent plots, and from their product seed was selected, as before. This was planted May 16, 1871, on two adjacent plots, in hills three feet by four feet apart, three grains to the hill. The following is a representation of the results:

	Description of seed.	Time of ripening.	Bushels per acre.
1	Selected from first ripe ears	August 10.	37. 51
2	Selected at time of husking	August 14.	42. 54

Single plants.—The reports of the Pennsylvania Agricultural College farms for 1869 and 1870, give a comparison between corn grown with one stalk for each foot of distance in the row, and that grown with three stalks every three feet. In 1869 the method of single plants showed, on the central farm, a gain of about 10 bushels of ears (of 35 pounds to the bushel) over the other method, and on the western farm a gain of about 2 bushels per acre. In 1870 the method of single plants exhibited, on the eastern farm, a loss of over 3 bushels per acre; on the central farm a gain of 10½ bushels, and on the western farm a gain of 1⅓ bushels per acre.

Shrinkage of corn.—At the experimental farm of the University of Wisconsin, in the autumn of 1871, characterized as a dry season, 100 pounds in the ear, of each of the seven varieties of corn named below, were taken at husking, being then in good cribbing condition, dry enough to allow five hundred bushels to be stored in a good crib without risk of heating or molding, and the whole was spread upon a loft and there dried. The corn was shelled January 2 and 3, 1872, being then in good merchantable condition, dry enough to put in large bins without consequent damage. The following table gives the weight per bushel of corn in the ear, at storing and shelling, with the proportion of shelled corn, &c.:

Varieties	Corn in the ear at husking. Pounds.	Pounds of ears at time of shelling.	Pounds of shelled corn January 2, 3, 1872.	Pounds of ears at husking required to produce 56 pounds of shelled corn.	Pounds of ears required to produce 56 pounds shelled corn, January 2, 1872.	Percentage, by weight, of shelled corn to corn in ear at husking.	Percentage, by weight, of shelled corn to corn in ear, Jan'y 2, 1872.
Early Yellow Dent	100	97¾	80	70. 00	68. 45	80	82
Dutton	100	97½	75	74. 66	72. 82	75	77
Cherokee	100	92¾	73	76. 71	71. 15	73	79
White Australian	100	96	80½	69. 56	67. 38	80½	84
Sanford	100	91½	72	77. 77	71. 15	72	79
Pearl Pop	100	96¼	76¾	73. 02	70. 18	76¾	80
Joint Pop	100	93¼	74	76. 19	70. 47	74	79
Average	100	95	76	73. 69	70. 23	76	80

In this exhibit Mr. McAfee, the superintendent of the farm, remarks

that the Cherokee variety of Dent corn and the Sanford variety of Flint make the poorest show, the latter losing 28 per cent. of its husked weight in moisture and cob. Both of these varieties, recently recommended as early, are there late, and the Sanford especially gives but a moderate yield.

COTTON.

Comparison of fertilizers.—The editor of the Southern Farm and Home reports an experiment made in 1870, near Athens, Georgia, in growing cotton with eleven different fertilizers, at a cost of about $15 per acre, the application being made in the furrow. The experimental field contained 24⅖ acres. The seed sown was the Simpson variety, carefully selected. The fertilizers employed were: Etiwan, No. 2; Patapsco guano; Schley's Georgia fertilizer; Crichton's superphosphate; Merryman's ammoniated dissolved bones; Brightwell & Bailey's; Sardy's; Colquitt & Bagg's planters' A No. 1; Ayer's ammoniated superphosphate; a mixture of one-third Peruvian guano, one-third dissolved bone, one-sixth ground plaster, and one-sixth salt, manipulated on the plantation; Zell's ammoniated superphosphate; and, on one-half of an acre, a compost of 150 pounds of hen manure, 50 pounds of plaster, 100 pounds of dissolved bone, 25 pounds of salt, and about 10 bushels of cotton-seed.

One plot of nine-tenths of an acre, which had been heavily manured in the fall of 1869 with stable manure and 75 bushels of cotton seed, and which in 1870 received 250 pounds of Colquitt's Planters' A No. 1, yielded at the rate of 3,171 pounds of seed cotton per acre. In the other 23½ acres the fertilizers giving the best returns were, in their order of largest yield, Colquitt's, the Peruvian guano mixture, Peruvian guano, the hen manure compost, and Schley's fertilizer. A summary of results for the whole field shows a total crop of 27,397½ pounds of seed cotton, averaging 1,122⅘ pounds per acre. The report places the product of seed cotton per acre from the unfertilized soil at not over 400 pounds, worth 4 cents per pound, and the cost of the fertilizers at $15 per acre, showing a gain in money value resulting from the fertilizing applications amounting to $339.50, or $13.91 per acre over cost of application. Setting aside the plot of nine-tenths of an acre, specially helped by a preceding fertilization, the gain on the remaining 23½ acres is found to be $10.40 per acre over cost of application.

Economy of application.—Mr. Thomas B. West, of Thompson, Georgia, whose experiment with fertilizers on cotton in 1869 was given in the report of this Department for 1870, page 463, planted the same land in cotton in 1870, without further application of fertilizers. The soil was naturally very poor, as is shown by the fact that the unmanured plot in the first season yielded only 284 pounds of seed-cotton per acre, and, in the second season, 256 pounds. A reference to the statement of his first experiment shows that the fertilizers then applied were Dickson's compound; Peruvian guano, dissolved bones, and plaster, in equal proportions; bone flour. These applications were at a cost varying from $8 to $24 per acre, and while those at the lower rates paid a good percentage the first year, some of the more expensive applications did not repay cost. But the crop of the second season, though selling at a lower price than that of the preceding one, so changed the exhibit, that, taking the two seasons together, a very liberal gain was received from the original investments, ranging from 121 per cent. on the bone flour application, at $24 per acre, to 333 per cent. on the Peruvian guano, dissolved bones, and plaster, at a cost of $16 per acre, the latter application giving the best return in each year. Mr. West concludes that hereafter, having used this description and amount of fertilizer in

the first of two seasons, he will in the next plant without fertilization.

In another field of poor quality, yielding 288 pounds of seed cotton per acre on unmanured soil, two adjoining squares of one-sixteenth of an acre each were selected; one was plowed ten inches deep with a two-horse turning plow, and the other four to five inches deep. Ammoniated bone was applied to both, at the rate of $10 worth per acre on the former, and $20 worth per acre on the latter. The former yielded 776 pounds of seed cotton per acre, the latter 832 pounds per acre, worth 5 cents per pound, the gain over cost of fertilizers amounting to $14.40, or 144 per cent., in the first case, and $7.20, or 36 per cent., in the latter. A comparison of effects obtained on two other plots, from applications of "Peruvian guano, bone, and plaster, in equal parts," and "Peruvian guano and bone, in equal parts," at a cost of $10 per acre, respectively, showed that the latter combination was the more profitable; the omission of the plaster involving less labor in hauling, and returning a larger profit. The largest net profits for the season, on this field, were obtained from Pendleton's compound, and Etiwan 1, at a cost of $10 per acre.

Mr. E. M. Pendleton, in an experiment with a "first-class fertilizer" on a mulatto soil, near Sparta, Georgia, applied it on five plots in quantities varying from 200 pounds to 600 pounds per acre, three unfertilized rows being left on either side of each fertilized row. The unfertilized rows averaged 643 pounds of seed-cotton per acre, and the largest profits of the season were obtained from applications of 200 pounds to 300 pounds of the fertilizer per acre, at a cost of $7.20 to $10.

Early maturity.—In another experiment, on poor land, Mr. Pendleton tested the effect of stimulating fertilizers in hastening the maturity of the crop. The experiment was on parallel rows, seventy yards long, each row constituting a separate plot, the area of which was a little less than one-fiftieth of an acre. The crop was retarded by a long drought in May, but afterward favorable rains pushed it steadily forward, giving vigorous effect to the manures, while the unusual length of the season assisted the growth of the unmanured plot and the more tardy fertilizers. The following table gives the fertilizers applied, at a cost of $10 per acre in each case, with the resulting products of seed-cotton per acre at the different pickings. Two hundred and fourteen pounds of seed cotton, at about 4⅔ cents per pound, were equivalent to the cost of each manurial application:

Plots.	Fertilizers.	September 15, pounds per acre.	September 24, pounds per acre.	October 14, pounds per acre.	Amount of three pickings, pounds per acre.	December 14, pounds per acre.	Total of four pickings, pounds per acre.	Per cent. of net profits on fertilizers, four pickings.
1	Nitro-phosphate	82	293	286	661	46	707	49
2	Ammoniated phosphate	148	513	263	924	20	944	159
3	Superphosphate	.33	204	302½	539½	131½	671	32
4	No fertilizer	3⅓	69⅓	201⅓	274	114	388	....

This experimental statement is offered as showing clearly the advantage of judicious stimulation in forwarding the cotton crop, especially in the more northern portions of the cotton belt.

An additional point is developed by comparing this experiment with one made in 1869, a season of severe drought. In that season nitro-

phosphate and ammoniated phosphate, applied at a cost of $10 per acre, in each case, returned substantially the same percentage of net profit, ranging from 149 to 157 per cent.; (see Report for 1869, page 287;) but under the rains of 1870, favoring the full development of the crop, the application of ammoniated phosphate returned 157 per cent., while the nitro-phosphate returned only 49 per cent., the two years taken together indicating a decided superiority on the part of the ammoniated phosphate, as well as illustrating the propriety of comparing the action of fertilizers under different conditions of season.

Applications of nitro-phosphates.—Mr. T. C. Law, reporting to the Hartsville, South Carolina, Farmers' Club, states experiments with cotton in 1870, on high, dry, sandy land, with a coarse yellow sand and clay subsoil, which had been a peach orchard for about twenty years, during which time it had received no manures. In 1869 the trees were cut down and the field divided into two portions, the first of which, here entitled Division A, was manured with the trash from a lot where hogs had been kept, and planted in sweet potatoes; the second division, B, manured with lot scrapings and guano, was planted in cotton. In 1870 the whole field was laid out with a wide shovel, in rows 4 feet apart, and a subsoil plow run in each furrow before manuring; while in Division A, lot trash was thrown in the furrow to help the action of the fertilizers. The following is a tabulation of fertilizers applied and results obtained, the seed cotton being valued at 4 cents per pound:

DIVISION A.

Order of largest profits.	Fertilizers in 1870.	Excess of seed-cotton per acre over unfertilized.	Cost of application per acre.	Gain resulting from application.
		Pounds.		
1	Green cotton-seed, 15 bushels; acid phosphate, 160 pounds	480	$6 92	$12 28
2	Green cotton-seed, 15 bushels; Etiwan, No. 1, 160 pounds	320	7 64	5 56
3	Green cotton-seed, 15 bushels; Chincha Island guano, 75 pounds	280	6 66	4 54
4	Green cotton-seed, 30 bushels	180	6 00	1 20
5	Green cotton-seed, 15 bushels; Guanape guano, 75 pounds	110	5 55	Loss, 1 15
6	Green cotton-seed, 15 bushels; Wando fertilizer, 160 pounds	110	8 12	Loss, 3 72

DIVISION B.

1	Guanape guano, 75 pounds; acid phosphate, 100 pounds	490	$5 00	$14 60
2	Guanape guano, 75 pounds; Etiwan, No. 1, 100 pounds	450	5 45	12 55
3	Chincha Island guano, 75 pounds; Wando fertilizer, 100 pounds	410	6 86	9 54
4	Chincha Island guano, 150 pounds	420	7 32	9 48
5	Guanape guano, 150 pounds	360	5 11	9 29
6	Guanape guano, 75 pounds; Wando fertilizer, 100 pounds	360	5 75	8 65
7	Chincha Island guano, 75 pounds; Etiwan, No. 1, 100 pounds	355	6 56	7 64
8	Chincha Island guano, 75 pounds; acid phosphate, 100 pounds	330	6 11	7 09
9	Wando fertilizer, 200 pounds	240	6 40	3 20
10	Acid phosphate, 200 pounds	190	4 90	2 70
11	Etiwan, No. 1, 200 pounds	210	5 80	2 60

The exhibit of this experiment favors, under the stated conditions of soil, the application of nitro-phosphates, with the phosphatic element in large proportion.

Dr. E. B. Smith, of Bonevinfo, South Carolina, reports experiments with fertilizers on cotton in 1871, on very poor land, of uniform appearance, a light grayish loam, underlaid by a coarse yellow subsoil, at the depth of three to five inches. In 1869 the land was dressed with super-

phosphate, and planted in corn, which was followed by oats; both crops were quite poor. The ground was broken for cotton March 20, 1871, about five inches deep, and afterward thirty-three rows were marked out, three and one-half feet apart, each row constituting an experimental plot of one-sixtieth of an acre. The fertilizers, at a cost of $10 per acre in each case, were applied to the bed before planting, which took place April 24. The product of ten plots receiving no fertilizers ranged from 60 pounds to 180 pounds of seed cotton per acre, averaging 101 pounds. The fertilizers exhibiting the best results for the season were: A combination of Peruvian guano and dissolved bone, (one part of the former to fourteen of the latter,) producing 780 pounds of seed cotton per acre—the guano contained 15 per cent. of ammonia and the dissolved bone was the article known as Etiwan No. 1, a constituent in Dickson's compound; Dickson's compound producing 690 pounds; Soluble Pacific guano producing 645 pounds; cotton seed and plaster in equal parts, moistened and composted for fourteen days, producing 630 pounds; Peruvian guano producing 630 pounds. Green cotton seed, and cotton seed combined with acid phosphate in equal parts, were among the other fertilizers employed, the product of seed cotton in each of these two cases being 495 pounds per acre.

Home-made fertilizers.—Mr. J. C. Farmer, Jonesborough, Georgia, states that in February, 1870, he broke up fresh land, a sandy loam, with a one-horse plow, and laid off three plots, of one acre each, for cotton, with rows five feet apart. One plot was not manured; the second plot received 200 pounds of a mixture of dissolved bones and stable manure, sifted fine, and applied in the furrow before planting the cotton; the third plot received 300 pounds of the same mixture. The first plot yielded 600 pounds of seed cotton; the second, 1,000 pounds; the third, 1,440 pounds.

Sea island cotton on upland soil.—Professor J. W. Mallet, of the University of Virginia, reports the following trial with sea island cotton on the university experimental grounds: Seed of this variety obtained from Savannah, Georgia, was sown in the spring of 1869, and from seed of the second year a third crop was obtained in 1871. The number of plants produced diminished from year to year, in consequence of the shortness of the season and imperfectly ripened seed, and the quantity of fiber from the plant was also diminished, the bolls being imperfectly filled out. But throughout the three years the distinctive character of the variety seemed to be preserved; the fiber retained its fineness, and, in great measure, its length. This exhibit is in opposition to the current opinion that the growing of the sea island variety on interior soils necessarily results in a change of characteristics, approximating the product to that of "upland" cotton, and Professor Mallet suspects that such changes of character heretofore noticed have been caused by hybridization. He recommends a repetition of the experiment on good soil in the interior of the cotton region, and at a distance, if possible, of fifty or sixty miles from fields of upland cotton.

RICE.

Rice on upland.—Major St. Paul, of Mobile, Alabama, states an experiment in growing rice on level upland twenty-two miles west of that city, and four miles from the Gulf coast; the soil, a sandy loam, free from gravel, with a gray clay subsoil at a depth of eight to fifteen inches. The land being in imperfect condition, and full of roots and clods, he found it necessary to make his drills nearly four feet apart, instead of fifteen to eighteen inches, which would have been the proper distance in soil sufficiently friable. The product of clean rice amounted to over

four barrels per acre, of fine quality, valued at $20 per barrel, and the straw to over one ton per acre, worth about $25, making a total of $105 per acre.

Mr. Cassibry, a neighbor, selected a high, level, and well drained lot of rich, mellow soil, not quite three-quarters of an acre in extent, which had been cleared two years before, but had never been under cultivation. He planted, early in April, in drills sixteen inches apart. The crop suffered greatly at first, but recuperated finely under the showers of July, and the crop harvested in the middle of October was at the rate of fifteen barrels of merchantable rice per acre, netting $17 per barrel, clear of all charges, besides an estimated yield of more than four tons of straw, worth $100 as forage.

A resident of Walthourville, Georgia, states that in February, 1871, he selected six acres of old field which had been in broom-sedge and weeds for ten years, plowed it thoroughly, and on March 20 planted it in cotton. This being cut off by insects, about the middle of April he plowed the land again, and planted rice of the common golden variety, at distances of two and one-half feet, in rows two and one-half feet apart. Three weeks afterward he ran small scooters on the beds, close to the rice, stirring and loosening the soil, so that the roots could strike deep. May 20 the crop received a good hoeing; and the field was again plowed June 13. A slight hoeing was given July 18. The crop was harvested at the close of September, yielding 171 bushels of clean rice, netting $1.15 per bushel, or a total of $196.65. Deducting $47.50, the cost of growing and cleaning, there was a net return of $149.15, or $24.86 per acre, not including the value of the straw.

POTATOES.

Comparison of different varieties.—Mr. Gerard C. Brown, of Croton Falls, New York, furnishes a report of his experiments with numerous varieties of potatoes, to which he has devoted special attention for the four years from 1868 to 1871, inclusive. The land is a warm, rich, alluvial soil, with a gravelly subsoil, possessing good natural drainage—an excellent potato soil. An abstract of the record of eighteen varieties, indicated as being particularly suitable for comparison, is presented below in a tabulated form. One-twentieth of an acre was allotted to each variety, the distances of hills and the method of cultivation being uniform throughout the several seasons.

The field of 1868, which had a clover sod, was manured with a compost of muck and cow manure, at the rate of 20 tons per acre, broadcast, and plowed under to the depth of nine inches, a shovelful of the compost being put in each hill at the time of planting, April 26; the distances of the hills were $3\frac{1}{12}$ feet by $3\frac{1}{4}$ feet. The Early Rose and Harrison were planted with two pieces in each hill, each piece containing one or two eyes; the other plots were planted with halved potatoes, of large size for the respective variety, two halves in the hill, six inches apart. The crop was worked three times with plow and hoe; the season was wet, and very favorable through June and July; the potatoes were harvested October 1, the yield unusually large.

The field of 1869 had been in corn the previous year, giving 85 bushels of shelled corn per acre. It was dressed for the potato crop with twenty-five tons per acre of partly rotted cow manure, well plowed in, and, in addition, a shovelful of compost in each hill at planting, April 20. The plots appropriated to the Early Mohawk, Early Rose, and Bresee's Prolific were planted with two small pieces in the hill, the other plots being planted with halved potatoes of good size; all received a subsequent liberal dressing of ashes and plaster. The season was quite dry, mate-

rially lessening the yield, especially of most of the early varieties. The field of 1870 had been manured in the previous spring for corn, with thirty tons of green cow manure per acre. It was dressed for potatoes with twelve tons per acre, broadcast, and six tons in the hills at planting, April 12 and 13. None of the seed was cut to single eyes. The potatoes got a fine start, and looked very promising until the long drought in June, which so affected them that only the very latest and hardiest varieties received their full development; both the Goodrich and the Harrison, recently favorite varieties, lost much of their vigor and vitality. The field of 1871 had been well dressed with barn-yard manure in the preceding season, and planted in cabbages and melons. The application for potatoes was forty tons per acre of well rotted compost, thirty tons broadcast and plowed under, the rest in the hills, with the addition of a handful of compost of ashes, lime, and salt in each hill. Planting was done April 3. The drought during May was extremely severe, and the greater part of the crop was seriously damaged; but Bresee's Peerless showed unparalleled vigor and excellent quality. In the following tabulation the numerals indicating the order of largest yield are intended simply as an approximate exhibit, in summary, for the entire period of yield:

	Varieties.	Quantity of seed per acre—in barrels.				Order of maturity.			Yield per acre—in barrels.			
		1868.	1869.	1870.	1871.	1868.	1869.	1870–'71.	1868.	1869.	1870.	1871.
1	King of the Earlies	......	......	2	3	......	......	1	......	......	80	44
2	Early Rose	5-6	1 2-3	3	2 1-2	1	2	2	100	53 1-3	63	40
3	Early London White	......	3	3	3	......	5	3	......	44 1-2	59	34
4	Early Mohawk	......	1	2 1-3	4	......	1	4	......	80	50	50
5	Excelsior	......	......	2 1-4	3	......	......	5	......	......	72	60
6	Early Goodrich	1 4-5	3 7-10	3 1-2	3 1-3	2	3	6	97 1-2	46	45 1-2	36 1-2
7	Garnet Chili	4 1-3	4 9-10	4	3 1-3	3	4	7	66 2-3	62	52	52
8	Bresee's Prolific	......	1	2 1-2	3 1-3	......	11	8	......	66 2-3	91	44
9	White Mercer	3 2-7	3 1-4	3 1-2	3	4	6	9	5	5 5-7	17	14
10	Harrison	1 3-5	3 1-3	4	3 1-3	6	8	10	125	83	47	66
11	English Kidney	4 1-2	3 9-10	4	3 1-3	5	7	11	70	62	50	32
12	Bresee's Peerless	......	......	2	2	......	......	12	......	......	83	160
13	White Peachblow	3 4-5	5 1-4	4	4	7	9	13	61 1-2	40	52	45 1-2
14	White-Eye Peachblow	......	......	4	3	......	......	14	......	......	71 1-2	47
15	Red Peachblow	3 1-3	4 1-4	4	3	8	10	15	55 1-2	40	51 1-2	44 1-2
16	Gleason	2 3-4	3 7-10	4	3	9	12	16	83 1-4	72	60	44
17	Cusco White	5	4 3-4	4 1-4	3 7-8	11	13	17	93	72 1-2	53	90
18	Chili White	......	......	3	4	......	......	18	......	......	114 1-3	88

	Varieties.	Approximate classification in order of largest yield.	Percentage rotten.				Order of excellence in table quality.		Selling price per barrel.			
			1868.	1869.	1870.	1871.	1870.	1871.	1868.	1869.	1870.	1871.
1	King of the Earlies	3	......	......	......	......	1	1	......	......	$10 00*	$7 00
2	Early Rose	3	2	......	1	½	1	1	$30 00*	$5 00*	4 00	2 50
3	Early London White	6	......	......	......	......	1	1	......	3 00	6 00*	5 50
4	Early Mohawk	3	......	......	......	......	2	2	......	15 00*	5 00*	2 50
5	Excelsior	2	......	......	......	......	1	1	......	......	6 00*	5 00
6	Early Goodrich	4	......	......	......	......	2	3	2 87	1 50	3 00	1 50
7	Garnet Chili	3	......	......	......	......	1	1	3 25	2 50	3 25	2 00
8	Bresee's Prolific	3	......	......	......	......	2	2	......	10 00*	2 50	2 50
9	White Mercer	......	90	50	7	10	3	3	3 00	2 00	2 60	2 00
10	Harrison	2	......	......	......	......	3	3	5 50*	2 00	2 00	1 25
11	English Kidney	4	5	1	......	......	1	1	3 00	2 25	3 50	2 25
12	Bresee's Peerless	1+	......	......	......	......	1	1	......	......	12 00*	5 00
13	White Peachblow	5	......	2	......	......	1	1	3 25	2 50	4 00	2 00
14	White-Eye Peachblow	3	20	......	......	......	1	1	......	......	6 00*	3 00
15	Red Peachblow	5	......	5	......	......	2	2	3 00	2 25	3 25	2 00
16	Gleason	3	25	......	......	......	2	2	3 50	2 25	3 25	2 00
17	Cusco White	2	......	5	1	2	3	3	2 25	1 00	2 50	1 00
18	Chili White	1	30	......	......	......	1	2	......	......	7 50*	2 00

The starred figures in the price columns show prices resulting from demands for seed. The large price of the King of the Earlies in 1871 resulted from its priority of arrival in the market. At late dates the Early Mohawk proves to be very poor in quality, and Bresee's Prolific and the Chili White continue to deteriorate. The Harrison and the Cusco White are suitable only for stock.

In respect to keeping qualities, it is remarked that early varieties have a tendency to deteriorate as the season advances; the Garnet Chili, in these experiments, showed a marked example of this tendency, while the Early London White and Excelsior were exceptions, passing through the winter in fine order, and proving of excellent quality when cooked. Bresee's Prolific and the Gleason improve after housing, and therefore should be kept until spring before using. The Early Goodrich, English Kidney, and White Mercer, once standard kinds, exhibit great deterioration in keeping qualities. Experience has shown a great difference in the vitality of varieties of potatoes. Some, of vigorous constitution—for instance, the Peachblow, Mercer, and Old Foxite, (now extinct)—hold their own for fifteen to twenty years, declining in yield before they do in quality; while others, inherently weak, become worthless in a few years, the Harrison giving example of this latter class. The fact that in many regions certain varieties fail, after a course of years, while at the same time they continue to maintain their vigor in other districts, is supplemented by the fact that a change of seed of any given sort, from one locality to another, tends to prolong the vigor of that variety, provided that the change be in the right direction. Experience has proved that this change should be uniformly from north to south. This principle is strikingly illustrated by the statement of Mr. Jessup, of Long Island, showing his continuous success in growing the Mercer potato, by use of seed from Maine. (See Report for 1869, page 418.)

Mr. Brown also reports on a large number of varieties raised by him from seed-balls of the Early Rose crossed with the White Peachblow, the statement covering the second season of growth. Here each plot contained twenty hills, with an area of four-fifths of a square rod, and was planted April 30, 1871, at the rate of 2⅗ barrels per acre. Of these seedlings he specially designates three early varieties, namely, Carmelite, exhibited as yielding 98 barrels per acre; Sedan, 100 barrels per acre; "No. 25," 100 barrels per acre; and three late varieties, Standard, yielding 154 barrels per acre; "No. 23," 102 barrels per acre, and "No. 37," 60 barrels per acre; all six being first class for table use, and showing great promise. However convenient the size of these seedling plots for preliminary trials, veteran experimenters have decided that, in practice, areas so small do not indicate results per acre with sufficient accuracy, differences in soil, &c., having a much larger influence on the comparative exhibit than they would on plots of greater size.

Vigor of English and American varieties.—The following is an abstract of a statement by Mr. John Dawe, gardener, of Launceston, Cornwall, England, on an experiment with nineteen varieties of potatoes, English and American: Taking one pound of each variety he divided it into eight sets, and planted May 20, 1871, in garden soil dressed with stable manure, placing the sets at distances of three feet apart, in rows three feet apart. The garden, being situated on a river bank, in a deep valley contiguous to a high moorland district, was subject to severe and unseasonable frosts, especially during this year, when the haulms were cut to the ground twice, namely, in April and the first part of June. The potatoes were taken up in the first week of November. The table

shows the product from each plot planted, giving a comparative exhibit of vigor on English soil. The varieties are arranged in the order of largest product:

Varieties.	Pounds from one pound of seed.	Varieties.	Pounds from one pound of seed.
Early Goodrich	30	Peach Bloom	15
Bresee's Prolific	30	Early Scarlet Emperor	10
Bresee's Peerless	29	Bresee's King of the Earlies	6
Red Skin Flourball	29	Pink-eyed Rusty-coat	5
Early Rose	26	Salisbury	5
Prairie Seedling	24	Bovinia	4
Wood's Scarlet Prolific	23	Fir Apple	4
Paterson's Victoria	23	Negro	3
Sutton's Scarlet	22	Early Racehorse	2
Cambridge Kidney	15		

Applications of potash.—Mr. C. D. Hunter, of Blennerhasset, England, states that 4 cwt. of muriate of potash, 80 to 83 per cent. in strength, at 10*s.* 6*d.* per cwt., with 4 cwt. of superphosphate, applied on one acre of a medium gravelly loam, produced 7 tons 16 cwt. and 89 pounds of potatoes, while another acre, of rather heavy loam, dressed with 15 tons of farm-yard manure, produced only 111 pounds more. Four cwt. of superphosphate and 4 cwt. of salt, on gravelly loam, produced the first year 6 tons and 16 cwt. of potatoes, and the next year the same manure produced 4 tons and 7 cwt. The results of numerous experiments lead him to recommend for potatoes an application per acre of $6\frac{1}{2}$ cwt. of superphosphate, 3 cwt. of muriate of potash, and $2\frac{1}{2}$ cwt. of sulphate of ammonia, as being much safer than the application of barn-yard manure.

FEEDING STOCK.

Experiments in feeding hogs.—An Iowa farmer reports an experiment made during the fall of 1870, in feeding twenty hogs, about one year old. They were fed twenty-eight days on dry shelled corn, consuming eighty-three bushels, and gaining 837 pounds in weight, an average gain of over 10 pounds to each bushel of corn, which was thus made to return a value of $50\frac{2}{5}$ cents. They were afterward fed fourteen days on meal, ground fine and fed dry, (a full supply of water being furnished,) and consumed forty-seven bushels, gaining 553 pounds in weight, or $11\frac{3}{4}$ pounds to each bushel fed, the corn returning a value of $58\frac{3}{4}$ cents per bushel. Afterward they were fed fourteen days on $55\frac{1}{2}$ bushels of meal mixed with cold water, and made a gain of 731 pounds, or $13\frac{1}{6}$ pounds to each bushel of meal, the corn returning $65\frac{5}{6}$ cents per bushel. They were then fed fourteen days on $46\frac{1}{2}$ bushels of meal cooked, with a gain of 696 pounds in weight, or very nearly 15 pounds for each bushel of meal, the corn returning $74\frac{4}{5}$ cents per bushel.

Experiments at the Maine Agricultural College.—Experiments made at the farm of the Maine Agricultural College, November 15, 1869, to January 15, 1870, in feeding four Chester pigs with whole corn and with raw corn meal, showed that the feeding value of the latter was $19\frac{4}{10}$ per cent. greater than that of the former. From January 15 to April 18, a trial was made with raw corn meal fed cold, and with corn meal scalded and fed blood-warm. The feeding value of the raw meal was found to be $4\frac{7}{10}$ per cent. greater than that of the scalded meal fed warm. During the two months ending April 18, trial was also made

in comparing the feeding value of barley meal with that of corn meal; the value of the latter was found to be $17\frac{6}{10}$ per cent. greater than that of the former. During the month ending May 19, raw meal was found to possess a feeding value nearly 50 per cent. greater than that of the fermented meal.

The superintendent of the Maine Agricultural College farm reports an experiment made during the present year, commencing May 23 and continuing ninety days, showing the value of cooked meal as compared with that of raw meal for feeding swine, to be as 100 to $74\frac{4}{5}$.

Advantage of early fattening.—The steer Uncle Abe, raised by Mr. C. S. Marvin, Oxford Depot, Orange County, New York, weighed at birth, October 19, 1864, 134 pounds, and measured in girth three feet and three inches. From the age of ten days he received daily one quart of meal and oats, this feed being increased gradually to two quarts; the cow had all the meal she could eat till spring. During the first summer the steer received daily three quarts of meal, with first rate grass; during the second winter, four quarts of meal and oats, and two quarts of roots; and during the second summer, four quarts of meal, this being gradually increased up to the last winter of his life, when he received eight quarts daily, besides the best of hay and roots. The following table represents his weight at different periods:

Age.	Weight.	Girth.	Gain.	Age.	Weight.	Girth.	Gain.
	Pounds.	*Ft. ins.*	*Pounds.*		*Pounds.*	*Ft. ins.*	*Pounds.*
3 months	385	4 6	251	30 months	1,830	7 4	214
6 months	670	5 0	285	36 months	2,070	7 7	240
12 months	1,036	6 0	366	42 months	2,270	8 0	200
18 months	1,354	6 5	318	48 months	2,360	8 2½	90
24 months	1,616	6 10	262	52 months	2,530	8 4	170

He was slaughtered fifteen days after the latter period, and gave 1,550 pounds of beef of excellent quality, the rough fat weighing 264 pounds. This record illustrates the general principle that the most profit is derived from feeding in the early life of the animal. Mr. George Geddes remarks that, judging from the weight at different periods, and from his own experience in handling beeves, this steer was fit for the butcher at eighteen months of age, and would then have been extra good beef; at three years and six months of age he had reached the highest point of quality.

Care of cows.—Mr. J. Wilkinson, of Baltimore, Maryland, states that two dairymen in Baltimore County, occupying adjoining farms, were in the habit of purchasing their cows and feeding material together. Their stables were arranged on the same plan; they kept the same amount of stock and fed in the same manner, their management being in all respects equal. Afterward one of these dairymen commenced steaming the meal and bran, reducing the amount 25 per cent. Each dairyman kept account of the results of his herd for the winter, from which it appeared that with a reduction of 25 per cent. in the quality of food, steaming showed a gain of 12 per cent. in milk, and 15 per cent. in weight over the herd fed with uncooked material. Mr. Wilkinson adds that in that section it is the usual custom to water cows only twice a day, bringing them to a trough of cold well water in the yard. So much cold water is then taken that a temporary chill is caused, from which it is estimated that during severe cold weather there is a loss of milk amounting to 20 per cent.

Economy of size.—German experiments favor the theory that, among cows of the same breed, the heavier animals consume less food in pro-

portion to live weight than the lighter ones, and yield more milk for each hundred pounds of food.

MISCELLANEOUS.

Thick and thin seeding.—The theory of thin seeding presupposes the best condition of soil, as regards richness, thorough pulverization, freedom from weeds, &c. The terms "thin seeding" and "generous seeding" are relative in their application. Mr. William Newton, of Henrietta, New York, states that, to test the effect of thin seeding of oats, one portion of a field was sown at the rate of two bushels per acre, the remainder of the field receiving a larger amount. On the first mentioned portion the crop was two or three days later than on the other part of the field, and showed signs of rust. He assumes that oats thinly sown are much more liable to rust, ripen later, and give a straw of inferior quality. The largest crops he has ever seen were raised from a sowing of 3½ bushels per acre.

Professor W. W. Daniells, of the University of Wisconsin, reports experiments with different amounts of seed per acre for spring wheat. Six plots of one-quarter of an acre each were sown, April 4, 1871, with seed of the Mammoth variety, weighing 60¾ pounds per bushel, which had been grown on the university farm in 1870. The wheat was harvested July 22 to July 24, and was thrashed about the 1st of November. The following table shows the amount of seed in each case, with the results obtained:

Plots.	Bushels of seed per acre.	Time of harvest.	Wheat per acre.	Weight per bushel.	Straw per acre.	Percentage, by weight, of grain to grain and straw.	Pounds of grain from one pound of seed.
			Bushels.	*Pounds.*	*Pounds.*		
1	¾	July 24	17. 53	60. 25	2, 228	32	23. 11
2	1	July 24	19. 83	60. 60	2, 406	33	19. 59
3	1¼	July 24	22. 18	60. 00	3, 253	29	17. 53
4	1½	July 24	26. 16	60. 36	3, 774	29	17. 40
5	1¾	July 22	24. 75	60. 00	3, 817	28	14. 17
6	2	July 22	30. 13	60. 50	3, 827	32	14. 68

An increased yield is shown according to the increase of seed, except on plot 5, which was in the most exposed situation, the crop being more laid by the wind than on the other plots. There is also shown a decrease in the product from one pound of seed, according to the amount of seed sown and the yield per acre increase.

Subsoiling.—The experimental reports of the three agricultural college farms of Pennsylvania, situated in the eastern, central, and western parts of the State, show, for 1869, an increased yield of corn resulting from subsoiling, on plots of one-eighth of an acre each; the largest increase being on the eastern farm, and amounting to a gain of between 6 and 7 bushels of corn in the ear (35 pounds to the bushel) over common plowing. A much larger gain was exhibited in subsoiling for potatoes on the central farm, the yield from subsoiled plots being 221½ bushels per acre, against 132 bushels per acre from common plowing.

In 1870, in subsoiling for corn, the eastern farm exhibited a loss of 11¼ bushels of ears per acre from subsoiling; the central farm a gain of 4 bushels per acre, and the western farm a gain of 9½ bushels per acre. The superintendent of the eastern farm states that in August, 1869, at

a public trial of plows, about one acre of land was plowed over, the weather being very warm and the ground exceedingly dry, and in 1870 the first plots of the subsoil series were laid out over a portion of this land. To this is attributed the apparent loss from subsoiling; and an illustration of the operation of this cause is shown in the fact that the latter nineteen plots of the series of thirty-one subsoiled plots gave a gain of 3⅛ bushels per acre over the corresponding plots receiving common plowing.

Manuring a means of resisting drought.—The influence of continued manuring in increasing the water-holding power of the soil, and enabling the latter to maintain a larger fund of moisture for plant use, is exhibited in a recent report by Messrs. Lawes and Gilbert, "on the effects of the drought of 1870 on some of the experimental plots at Rothamsted, England." The soil experimented upon was a rather heavy loam, with a red clay subsoil resting on chalk, and had a good natural drainage. In that portion of the wheat field which has been yearly dressed with 14 tons of farm-yard dung per acre since 1843, the pipe-drains have scarcely ever discharged water, while those on the other plots have run freely several times a year. The following table shows the number of tons of water, per acre, held by the unmanured and manured plots, to the depth of 36 inches, at a period of drought and at the close of heavy rains:

Plots.	Manures applied.	Dry. July, 1868, tons of water per acre.	Saturated. January, 1869, tons of water per acre.
1	No manure since 1839	666	1,396
2	Mineral manures and ammonia salts since 1843	694	1,549
3	Farm-yard manure since 1843	591	1,610

A comparison of the percentages of moisture retained in different layers of soil, after the removal of grass crops in the unusually dry season of 1870, on plots unmanured and plots dressed with artificial manures, showed a larger percentage of moisture in the first nine inches of the manured plots than in the corresponding layer of the unmanured. On the other hand, the lower layers of the manured plots showed a smaller percentage of moisture than those of the unmanured, as the far-reaching roots of the heavy crops derived from the manured plots had removed a large amount of water from the lower soil.

Removal of fertilizing elements by drainage.—Professor Voelcker reports as follows on experiments made during a course of years at Rothamsted on the loss of nitrogen and other fertilizing elements by drainage: It is found that, in whatever form nitrogen is applied to the soil, a considerable percentage is carried off in the drainage. Nitrate of soda, especially, is readily removed through the action of rains, and should, therefore, be applied late in spring—in the middle of March, in England. Sulphate of ammonia and other ammoniacal manures may be applied a fortnight earlier, at less risk of being washed away. Fresh farm-yard manure, on the other hand, should be applied in autumn. Potash and phosphoric acid, the most important mineral constituents of soils and manures, are almost wholly retained in the soil.

Profit on improvements costing $185 per acre.—A correspondent of the

American Agriculturist states that eleven years ago he bought a field which was wet in spots, rough with stumps and bushes, and quite stony. With laborious culture a portion of the field produced 34 bushels of corn per acre, and another portion 67 bushels of potatoes per acre. Having some money in hand, he concluded to invest it in a thorough renovation of the field, instead of putting it on interest at 7 per cent. Engaging a party of men just discharged from a railroad, he had all the stones which could be conveniently handled sunk in large drains, the larger ones buried in holes dug under them, the roots and brush burned, and the land spaded two feet deep, keeping the best soil on top, digging in manure plentifully, and picking out all stones as large as a hen's egg. The cost was $185 per acre, money being borrowed to finish the job, and the operation was characterized by the neighbors as a wasteful one. The result has been an average yearly gain, for the past ten years, of 42 bushels of corn per acre, worth 83 cents per bushel, without any extra current cost of production, showing an annual interest of $34.86 on $185, or $18\frac{5}{8}$ per cent., while a portion of the field when in potatoes has yielded as high 50 per cent. per annum, on the same investment per acre.

Curing hay.—Mr. W. M. Larrabee, of Searsport, Maine, says that, before his grass was fully ripe, he began one morning at 9 o'clock, the grass being perfectly free from dew and all outward moisture, and mowed two tons with a machine, which amount was put on the barn scaffold at 2 p. m. The mow received no further care, and went through a process of heat and sweating, which rendered the upper layer of ten to twelve inches in thickness unfit for feeding, but the rest made an excellent hay, rich in food substance and much better relished by stock than the common hay.

Experiment with Alsike clover.—Mr. J. B. Turner, of Jacksonville, Illinois, states that about the middle of May, 1871, he sowed Alsike clover on six acres of the common, dry, rolling prairie soil of that section, using three to four pounds per acre, with the usual amount of timothy seed, sowing on ground well harrowed. The weather was so dry at the time that some of his most experienced neighbors prophesied that he would lose his seed; but, notwithstanding there followed several weeks of a drought unparalleled for thirty years, the whole field was in blossom by the middle of August, and by the 1st of October had grown "half knee high," affording abundant fresh feed for his cows and horses. He believes the Alsike to be hardier and more prolific than the red and white clovers, and that it furnishes more food and of a better quality.

Transpiration of plants.—Experiments by Dr. McNab, of the Royal Agricultural College of England, show that in the sun plants transpire most in a saturated atmosphere; in the shade transpiration ceases when the atmosphere is loaded with watery vapor.

Nitrogenized marl in compost.—The following is a statement of an experiment by M. Bortier, an eminent Belgian agriculturist: Commencing in spring, a large quantity of stable manure was spread in a farm-yard, under cover, and divided into three equal parts. The first part was left to be trampled by stock; the second portion was kept from the stock; and the third portion was put in alternate layers with marl, the latter being in weight about three per cent. of the manure. In September these manures were applied on three plots of loamy land of uniform character. For four crops in succession, without further manuring, the plot dressed with the marl compost produced 10 per cent. more than either of the other plots. Chemical analysis disclosed the formation of nitric acid in the marl thus treated, and further experiment

showed an additional advantage gained by mixing old plaster and mortar with the marl before composting. In this experiment 1000 parts of marl, placed in layers among stable manure for two months, was found to contain by analysis 0.69 part of nitric acid. One thousand parts of marl, mixed with fifty parts of old plaster and mortar containing 0.62 part of nitric acid, and composted as before, was found at the end of two months to contain 2.3 parts of nitric acid. Subtracting the nitrogen originally contributed in the plaster and mortar, the nitric acid formed in the marl was more than double that obtained in the other experiments. In M. Bortier's opinion, the particles of limestone thus nitrogenized continued for years to absorb atmospheric nitrogen, and to communicate fertility to the soil.

Compost of muck and shell lime.—A New England farmer states an experiment with muck composted with oyster shell lime and ashes, in connection with fine stable manure, the two fertilizers being spread on a meadow in alternate strips of two rods in width. The first season after application there was no perceptible difference found in the effects of the two manures, but succeeding seasons indicated a decided gain of the muck compost over the stable manure. So far as his experience goes, he finds confirmation of the doctrine of Dana's Muck Manual, that three cords of good muck composted with a cask of lime slacked with a saturated solution of one bushel of salt are about equivalent to the same quantity of good stable manure.

Concentrated manures in compost.—Mr. Louis Froelich, of Kenansville, North Carolina, states that he has found, by repeated experiment in different modes of application, that concentrated fertilizers used alone on the light, sandy soils of his section are injurious instead of beneficial, serving to stimulate plants in the early part of the season but afterward leaving them in a sickly condition. Even on clay soils and on low moist lands he did not realize the worth of his fertilizers. But using them in compost with stable manure, good muck, and marl, forest leaves, &c., he has obtained very remunerative results.

PRACTICAL IRRIGATION IN COLORADO.

There has been a great lack of experienced irrigators in the United States, and consequently irrigation is carried on in a very primitive manner. The Eastern States generally have not realized its importance, while in the Western the usual slovenly mode of farming has deferred what was erroneously supposed to be a very costly improvement. In the drier climates of the far West farmers have been compelled to adopt a *quasi* style of irrigation, based upon a slight knowledge of European modes. Even here they have supposed that the modes practiced in England, France, Italy, and Germany were equally adapted to this climate. This was a great mistake, and many have been obliged to unlearn all they had read and heard of European irrigation, and begin from the "bed-rock" to acquire, by experience, a better mode. Sometimes they would put in too much water, sometimes too little; tender plants, requiring little water, would be deluged, on the supposition that they required as much as the hardier kinds.

There is scarcely a farm in the United States but is susceptible of irrigation in some way or other. It is a very easy matter to plow a ditch from some stream to the highest point of your farm, or as high as you can get the water to run. If the distance to the stream is too

great for your own work, and you are afraid of the expense, let the neighbors club together on a mutual co-operative or joint-stock plan. Any intelligent farmer can supply the details. If it is one, two, three, six, or a dozen miles, it matters not. By the co-operation of the whole township, pecuniarily and by sympathy, success will attend it. In Colorado, California, and the Pacific slope ditches are sometimes built fifty miles in length. The only water supplied to Denver for irrigation during eleven years has been by a ditch twenty-four miles long; and such a ditch can be built by the combined work of farmers, with a very small cash outlay. Let not the distance of the farm from an available fall of water deter any one in the outset from investigating the matter. If there is an elevated point on a farm upon which it is impossible to bring the water by an open ditch from a distance, a well may be sunk on the crowning point, an ordinary suction pump put in, and with a small windmill, which one can make himself if he cannot afford to buy an improved patent, a constant stream can be obtained for use whenever needed. A reservoir or pond near by will economize a body of water as a reserve in case of drought. If the strata of water is too low for a suction-pump, a belt of cups may be used. Leather or rubber belting, with cast-iron cups, is made for the purpose; but rawhide belting and tin oyster-cans have answered temporarily; and the success of this expedient was astonishing. If one is not disposed to use a windmill, a common gin, or whim, as it is called in the mountains, or a thrashing treadle-machine, with power supplied by a donkey, oxen, mule, or horses, will answer the purpose. With very slight appliances of such a character many a magnificent field of golden grain may be saved from absolute loss on the occurrence of a drought. The more wealthy farmer can easily improvise more extensive machinery to meet a larger demand, or almost any exigency. The old Archimedean screw has been utilized for raising water, and an immense body, 10,000 gallons per hour or more, can be raised from almost any depth by the application of a corresponding ratio of motor power. There is no necessity of losing a crop by drought. If it is lost, it is by improvident or ignorant farming. There is scarcely a spot on the great plains where water cannot be obtained in sufficient quantity to irrigate 80 acres of land at a maximum cost of $500.

The occasional high winds in Colorado are very disastrous to ordinary windmills, unless protected from the prevalent wind blasts. Mr. Butters, a farmer on Cherry Creek, nine miles from Denver, has used one of the ordinary windmills for pumping water with a two-inch pipe and a cistern-pump. It worked admirably for five days with a common breeze, but on the sixth day a high-pressure blast carried away the vane, fans, and all the wind apparatus, leaving the machinery for pump, &c., standing naked and alone. A windmill with adjustment for opening and closing the fans, as the wind is increased or decreased, is the only kind adapted to Colorado.

THE LEVELS.

The farmer must ascertain the altitude of his farm at different points. The best way would be to engage a surveyor, and let him take the levels at various points; ascertain the highest, and run a line in the direction of the nearest stream, if possible avoiding plowed fields, and, when practicable, keeping on fence-rows or on the sides of roads. The surveyor should be judicious in his selection of the ground for his ditch; if he can choose, he should select a good, solid, clayey soil, as nearly impervious to water as possible. Judgment in this matter

should be cautiously exercised. A fall of about 2½ feet to the mile should be obtained, if possible; 1 foot to the mile may barely suffice. Water will run at a fall of 8 inches to the mile, corresponding with the curvature of the earth; but in a small volume of water it is not enough. The smaller the stream the greater the fall allowable, up to about 3 feet. Above that, it is not desirable, as it will fill up with *detritus*, sand, or gravel. A ratio corresponding with a medium fall of about 2½ feet to the mile is preferable, neither permitting vegetable growth in the channel nor carrying down sand or gravel to choke it up and cause the breaking of the banks of the ditch.

It may be very probable that one survey will not be sufficient to locate a good and permanent line of ditch. A dozen lines have sometimes been run before a determination is arrived at; and it is good economy to examine each line critically, because, by the expenditure of a few hours' work at this initial point, a great deal of expense may be saved in the future. An hour or two of due consideration on the part of the surveyor may save a thousand yards of excavation, and he should therefore be allowed his own time and plenty of help. The width of the stream from which the water is taken should be as narrow as possible, to save money in the construction of the dam. The solidity of the bank should also be regarded in the choice of locality for dam and sluice-gate, as the washing of the water round the timbers of the sluice or head-gate must be guarded against, or at the first high water the whole structure may be deposited piecemeal in a potato-patch or wheat-field. It is possible for a farmer to get along without a surveyor in his survey of a ditch; especially if he provides himself with one of those elegant little drainage and irrigating levels which are in the market at a low price. An ordinary carpenter's or mason's spirit-level might suffice, as it very often does, where the farmer is compelled to exercise the most rigid economy.

THE DAM OR WEIR.

The selection of a place for a dam should be guided by the character of the bed of the stream, the narrowness of the channel, the rapidity of the current, &c. It can be made of any size or character, from the magnificent structure of historic fame down to the little sandy dam we used to construct in our boyhood to float our tiny crafts upon the gutter. If an expensive dam is desired, a mill engineer should be engaged for the purpose. A log-dam can be constructed cheaply when occasion requires it, but for a small irrigating ditch nothing of so costly a character is ordinarily used. A row of piles may be driven close together across the stream, varying in size according to circumstances, from 12 to about 3 inches in diameter. In Cherry Creek a farmer has been known, in the dry season, to throw up a little dam of horse-manure, sand, and willow branches, and with it turn the water into a ditch carrying about 150 square inches of water, by which he saved an excellent crop of farm and garden produce and several hundred fruit trees. The farmer is his own best judge of the kind of dam he needs, especially when he is aided by the advice of a careful and judicious engineer.

Mr. Magnus has twice changed the whole volume of the Platte River by a simple brush-dam, and it can still be seen near Denver as a monument of the fact, with the brush sprouting out and a bunch of nice cottonwood springing from it. The river bottom was of loose gravel and sand. He says he has more success with brush than with anything else. Large stones and logs increase the current too much, and cause washing. Brush and hay are particularly effective in constructing dams on shifting sand. A low dam should be as wide at the top as the height; the

front or breast slope should be three feet to one, and the back slope two feet to one. These dams are called perfect dams when the top is above the water, and imperfect, or submerged dams, when the surplus water runs over the top or sill.

Wing-dams extend partly across the stream, and these are most generally used for temporary farm irrigation. The difference of their span across the stream is the only peculiarity. They, of course, do not raise all the water in the bed; but if they point diagonally up the stream from the head-gate, they can raise all the water necessary for the purpose of the farmer. This statement must be taken with caution, as wing-dams will not pay on a moving bottom of sand. With a substantial bed-rock or clay strata, a permanent wing-dam may be good; but on the sand of the torrential streams of Colorado they will ruin any farmer who expends a large amount of money on their construction. One of the most enterprising millers of Colorado has been ruined by the outlay expended on wing-dams in such a connection. A simple bar may be all that is needed to pen up the water and divert it into the sluice. This must be left to be improvised according to existing circumstances, as it would be but a very temporary structure, and liable to be carried off every night. Calculations should also be made for floods and freshets.

THE SLUICE, HATCH, OR HEAD-GATE.

This is a very important part of the economy of irrigation, and should be located in a bank with a firm, solid ground of the most compact material, so as to obviate the necessity of repairs from the degrading influence of the water. It is usually made of a square frame, well bolted, primed, and dovetailed together, like the window-frame of a house, only of sufficient strength to withstand a heavy pressure of water; and in place of sash, some 2-inch plank, about six inches deep, one above the other, fitted in, and capable of working up and down by means of a lever or chain-pulley in a groove on the sides of the frame. This will let out the water from the dam and main stream in quantities to suit demand or exigency. If the bottom of the sluice-gate is placed down level with, or even a little below, the bed of the stream, it is better, as then a choice of either bottom or surface water can be obtained, and can be employed at any time to keep the collection of silt or accumulations as low as desirable. Sometimes, and it is certainly better, a double sluice-gate is arranged with one at each end; a strong plank box, flume, or aqueduct between. This makes the whole structure stronger, and is a better protection against floods and freshets. These hatches or sluices can be raised from the top or bottom, and the amount of water graduated to accommodate circumstances. Another kind of movable frame is made of planks, working upright or on end. The water by these can only be admitted at the floor of the sluice. These gates are so commonly used in connection with mills that a further description is unnecessary, as any person can see one but a short distance from his own door.

In building a sluice it is better to excavate a little deeper than run the risk of the embankment being below high-water mark, or of poor material. The initial cut at the head-main should not be at a right or acute angle, as it tends to create resistance to the current, and occasion rebounds from one side to the other, which probably may cause undermining. The line of the ditch should be, as near as circumstances will allow, with a due regard to permanency, continued with the line of the mother stream, so that the current will be uninterrupted in its easy

flow. If the water is taken out at a tangent with the supply stream, mischief and disaster by impingement is inevitable. The angle should be rounded as near Hogarth's line of beauty as is possible.

Artificial embankments, of which there are several forms, such as earthen, sod, or rock-wall, either dry or cemented, earthen mounds with reversed slopes, faced with stones, piles, brush, sod, or wicker-work, all can be used for the purpose. Where the escarpment of the bank is of a sandy or gravelly character, the willow, osier, and a thousand other plants and trees which will bind the bank in a solid mass, and compact the drift-sand with a surface of alluvial soil, can be used with success. In Colusa County, California, the Agricultural Report of October, 1871, says:

> Our farmers are making flood-gates out of wrought iron instead of wood. Where there is no rain for six months, wooden gates shrink, and are apt to break the next season. We are now making round tubes, one to six feet in diameter, with the gate in the upper end.

THE HEAD MAIN DITCH.

This ditch is first marked out by the surveyor's stakes, usually 100 feet apart, and followed by a good plow to mark the line; it is not essential to follow the surveyor in every minute turn in the line, as the difference of level in 100 feet, at a fall of 2½ feet to the mile, is only about half an inch; so if a close approximation is arrived at, it will be sufficient. The eye of an intelligent farmer or teamster can save quite a distance in a mile, by watching these corners, without any loss of fall. When the line of the ditch is well marked, then return and run a parallel line to mark the width of the ditch; then the heavy ditching plow and scraper should be used. Some very excellent ditchers are made, both in Europe and in the United States, which make ditching a very easy job.

In regard to the size of the ditch, calculation must be made as to the number of acres to irrigate; 50 inches for 80 acres would usually suffice for ordinary farm crops; garden crops want more; the rice crop still more. Then, again, other matters must be taken into consideration, such as the quality of the soil and the amount of evaporation and seepage. If it is very sandy, more water must be used, as it will lose by percolation more than an impervious clay soil.

The amount of evaporation is a large item in a long ditch. Mr. J. W. Smith, of Denver, one of the stockholders in the Platte Water Canal Company, informs me that out of about 1,700 inches of water at one point in their ditch, not above 1,000 are sold and utilized when it reaches a point eight miles below; the remainder, about 700 inches, is lost by evaporation and seepage. This is a wide and shallow ditch. In some places it is eight feet, in others six, and down to eighteen inches of fall to the mile. It is a well established principle that the deeper the amount of water carried by a ditch, in proportion to its width, the less fall is necessary, and the loss is much smaller from evaporation and seepage. According to the best authorities, a velocity of seven or eight inches per second is necessary to prevent the deposit of slime and vegetable growth, and about fifteen inches per second the deposit of sand. Thus the mean velocity need not exceed, over a slimy bed, 8 inches per second; over a common clay bed, 6 inches per second; over a river sand-bed, 15 inches per second; over a gravelly bed, 18 inches per second.

A superficial observer might suppose that seepage is influenced very much by atmospheric or even the water's own vertical pressure; but it is not so, except in a very minute degree. Let us remember that an oak flume or channel, water-tight, holds water without seepage; flumes and channels of other material can be made impervious to seepage.

There are many kinds of material used in the construction of ditches that will prevent seepage, and different materials can be found, on a graduating scale, calculated upon acknowledged scientific formulas, of every kind of porosity, including white sand, fine gravel, coarse gravel, shingle, small bowlders, up to large ones, through which the water will percolate as through a sieve. In fact, all soils are really sieves of different degrees of fineness.

Materials properly prepared can be found other than wood, stone, iron, &c., which will prevent the seepage of water, at least to any great extent. A ditch can be constructed over a sand-hill, where 50 inches will be lost in running 100 feet. The same ditch can be prepared by artificial bottoming which will carry the 50 inches of water for a length of ten miles with scarce any perceptible loss.

A deeper ditch can be run at a less fall, thus economizing surface exposed to the heat of the sun's rays, and thereby decreasing the evaporation. In constructing ditches of a small fall, the deposit of slime, sand, and vegetation diminishes the sectional area, and impedes the current. They should be always kept well cleaned. The course of a ditch should be as straight as possible, if velocity is desirable; the more frequent the curves the greater the loss of velocity; the actual loss by curvature has been calculated and tabulated. The ditch should not be made too large, too wide, or too deep; it can always be enlarged either by widening or deepening, when necessity requires. When practicable it is better to construct a ditch by plowing two or three furrows, which can be done by unaided labor with a span of horses, than to pay out ready cash for assistance when it really cannot be afforded. A very useful size of ditch in a hard, compact soil is six feet wide at the surface, three feet at the bottom, and three feet deep. If the soil is loose, the slope to the banks must be more extended.

If a lumber channel is desired as a flume, a square-sided box will do, as the object in the slope of a ditch is to prevent its washing or degradation. Such a ditch will irrigate, at 50 inches to 80 acres, 3,200 acres. This will cost about $400 per mile in Colorado, calculating the excavation at 15 cents per cubic yard. If several neighbors join together to construct such a ditch, it may decrease in size as each in succession draws from it. For instance, if twelve neighbors join together, they can each drop off six inches in width, or its equivalent of width and depth, and have plenty of water for all their purposes. The price of the whole ditch can be equalized between them, making the aggregate expense very light.

FALL OF THE MAIN DITCH.

A fall of 1 in 9,288 gives a mean velocity of 6 inches per second in an artificial canal; 1 in 27,000 gives a mean velocity of 7 inches per second in a drain near Conde. Ancient aqueducts show a fall of 1 in 432 to 1 in 643. The fall of the new river or canal which conveys water to London is on a scale of 0.21 foot per mile, or 1 in 21,120. Its motion is a half mile per hour. This is too slow, since, during the summer, the temperature of the water is raised in consequence. The fall of the grand Ganges Canal is 1 in 3,520; that of the culvert of the Croton waterworks equals 1.125 feet per mile. The artificial canals in the Dutch and Austrian Netherlands are 30 to 40 feet per minute mean velocity, and from 2 to 9 inches to the mile. The Illinois River, in a distance of two hundred and twenty miles, has a fall of only 25 feet. The Platte River below Denver has a fall of 11 feet per mile; but it gradually decreases as it approaches the Missouri River. Cherry Creek, from its source to its mouth, at Denver, has a fall of 35 feet to the mile; but it is filled

with sand all the year round, except at the time of the spring floods, after a heavy fall of snow in the mountains, or a peculiarly rainy season.

Colorado, on account of the great fall to her streams, is singularly fortunate in regard to irrigation. In all mountainous countries, the plains gradually slope toward the larger water-courses or great arteries of the different hydrographic systems of the globe. Like the plains of Lombardy and Abyssinia, the Great Plains of Colorado, gradually sloping gradually decrease in fall. The Adda and the Ticino, in Italy, in some of their characteristics, are much like, the torrential streams of Colorado. As the mountains of Egypt are to the plains of Abyssinia, so is the Sierra Madre of the American continent to the Great Plains of Colorado and Kansas.

Some of the hydraulic ditches in the mountainous districts of Colorado employed for ground sluicing, &c., have an immense fall, and tax the great rubber and canvas hose to the very utmost. The ditch of the Platte Water Canal Company, with its heavy fall in some places, is of course choked with sand, and its banks are continually breaking. If a main ditch is very rapid, and the fall heavy, the slope of the banks must be considerable, or the washing will work serious trouble and break through, cutting crevasses by its action, and disfiguring the farm. It is best, therefore, to sow grass on the slopes and banks; it holds the whole together, and is a great help to the beauty and permanence of your ditch. A main ditch should never have over 2½ feet fall per mile. This pinches old prejudices of a few farmers, but long experience and all scientific authorities prove the accuracy of the statement.

FLUME, CHUTE, OR AQUEDUCT.

In ditching, there may be gullies, cañons, streams or depressions in the surface of the farm, over which you want to carry the water, where it will be cheapest to construct a flume or aqueduct either of lumber, logs, earthwork, rock, or pipes. In such case, the cost of each should be carefully computed. A lumber flume will not last above five or six years, and if the water does not run all the year round, the sun, when it is dry, will so warp and twist the planking as to make it leaky, and act like a colander, or sieve, thereby losing a great many inches of water. There is a tendency among Americans to construct everything with an eye only to the present. Europeans generally build with reference to permanency. The old buildings now standing in England, monuments of durability, constructed eleven hundred years ago, bear witness to this fact. The tendency to put up works of a temporary character should be checked as much as possible. Foundations should be more substantial, and every flume, aqueduct, dam, bridge, or work of public improvement should be built of rock. Lumber flumes are only like shells or toys; earthwork flumes are like sugar and salt arrangements, at the mercy of the gophers, winds, and storms; sheet iron is better, but not so good as rock, which will scarcely require repairs. The water-way should be lined with cement or puddle, to prevent the walls from being saturated.

PUDDLING, OR ARTIFICIAL BOTTOMING.

In Europe this is known as puddling, and requires an intimate knowledge of the composition of soils, their compactness, their durability, the exact amount of their porosity, and their solubility. There are two kinds, constructive puddling and puddling by deposition.

Constructive puddling.—It is useless for a novice to attempt this description of work on ditches. A mere puddle of water or clay is not

sufficient. It requires working with as much care as the clay for a well molded brick. Surface alluvial soil, found on the banks of our streams, will not do. It wants a light loam, very different from clay, with a slight admixture of course sand or fine gravel, well worked with a spade to a proper consistency with water, so as to form a kind of concrete, though it does not partake of the character of concrete. In California and Utah, horses, oxen, and even men are used to work the puddle to a proper consistency with their feet. Putting it when properly compounded into a brick-machine will do better than anything to prepare it for plastering or daubing (to use a common expression) the bottom and sides of a ditch. If a ditch does not run water all the year, puddling may as well be omitted; for the cracking from exposure to the sun will be so great as to make it almost useless. A brick-maker, who would naturally be supposed by the novice to be the best person to select puddling stuff, is the worst, as he would select the same material which he would use for making brick. In fact, it is only by experience that one can learn to choose good puddling stuff. It is true that farmers in Colorado are using the common alkali bottom clay to puddle their ditches, and have approximated to a *quasi* success; but in every instance where it has been used the ditch cannot be relied upon for economical work. Probably, however, this alkali clay, if the farmer is short of water, and does not understand the better process, will suffice in a rough way, for ordinary purposes, but certainly not for a permanent and substantial structure.

This artificial bottoming, or puddling, is of vital importance where the scarcity and the great evaporation makes water valuable. The farmer of the western side of our continent should experiment and acquire a practical knowledge by observation in regard to it, as the greater the density of population, the more urgent will be the necessity for its use. He cannot afford to look hastily over this part of the economy of irrigation.

Puddling by deposition.—Every current of water carries with it certain sedimentary deposits of *debris*, which are the accumulations from localities disintegrated by certain influences, oftentimes by the stream itself. These deposits are of a great variety of composition and material, from small rocks down to the gravel, sand, clay of various densities, mineral earths, alluvial soil, and vegetable matter. The kind or description of the sedimentary deposit depends on the velocity of the current or the fall. These deposits can be used as a lining or cement for ditches, if proper care is used in the depth of fall and the choice of ground for your ditch courses. After the deposit of one kind of earth, an experienced engineer will, by a change of fall, bring down a different kind of sediment, which, deposited along, will make a cement, capable of resisting the action of water from either seepage or leakage. A popular scientist of the present day says: "By this gradual cementing process, already alluded to, or by an interruption of the aqueous action, the alluvial layers may become so hardened as to form a new bed-rock."

The immense evaporation of water from ditches is a serious loss, which should be obviated as far as possible by the protection of the water in the ditches from the action of the powerful rays of a vertical sun. Covering the ditches by planking or arches, of course, would not be economical, therefore not feasible. This loss may be decreased by reducing the evaporating surface—making the ditch as narrow as practicable. Trees are a very important material to use for this purpose—the cottonwood, box elder, locust, and the willow. The last is probably the best for this purpose, as it grows very rapidly, especially the basket or osier willow.

MEASURING WATER.

What is an inch of water? Some of our engineers will tell you an inch of water should be measured with a six-inch, some a five-inch, some a four-inch head, and so on, according to the whim of the party, or the object sought to be obtained. Why is there so much confusion? It is simply because every one measures an inch of water to suit his own particular views.

The pressure doctrine no doubt originated in countries or localities where hydraulic force was required, and not where used for simple irrigating purposes. In mountainous sections, where hydraulic mining is carried on, of course they stipulate for a certain pressure at the head; so also with water for power in our mills; but, if an inch of water without stipulation as to head is contracted for, the contractor would not be compelled to furnish more water than the efflux of a stream through a square inch orifice, with a head only of a line above the surface of the opening. The most proper way to measure water, to buy or to sell it, is by the gallon per second, per minute, per hour, or per day. This can be calculated to a nicety, as every kind of velocity has been reduced by the ablest mathematicians to minute formulas. Take a bottle partially filled with water, let it float down the stream to be measured, between two points designated by poles or ropes thrown across, say for 100 feet, then take a good stop-watch, and note the length of time the bottle is floating between the given points; get the mean width and depth of the stream forming the sectional area; then multiply the velocity per second by the sectional area, and you obtain the volume in inches or feet as you think best; then divide by the cubic inch contents of a gallon, and the result is ascertained for any time you wish, per second, per minute, &c., &c. An "inch of water" is not the same as a cubic inch of water. Many irrigators who are not versed in mathematics or engineering, are apt to call it "a cubic inch of water;" this is a mistake; a square inch of water would be correct as irrigation is measured in the far West. The old German mode of measuring an inch of water was by a round orifice one inch in diameter. The Platte River Canal Company obviates the trouble of disagreement on the measurement of water by stipulating how it shall be measured at the hatchway, where the water is taken out. They do not agree to give an "inch of water," or inch of water under certain pressure; but merely a volume of water running from their ditch filling a hole of certain dimensions.

RESERVOIRS.

In connection with the head main ditch, it is oftentimes desirable, if you have favorable depressions in the land, to form reservoirs into which you can have a continuous stream of water running during the time not devoted to irrigation, and for the purpose of getting rid of your waste or surplus water. These reservoirs, lakes, or ponds, are useful for a multitude of things; for instance, as a reserve in case your stream of water may fall short at your head main, or by reason of accident or other emergency. A reservoir may be made at the head of a ravine, by throwing a temporary dike or embankment across from side to side, with a sluice level with the bottom, for draining or irrigating lands below it. Fish can be kept within it, aquatic fowls can be bred there, and a fine stock watering-place can be assured all the year round, besides furnishing all the ice for the neighborhood during the summer months. The main ditch may be tapped to fill it at any point in its line by a hatch or sluice-way, to open or close at pleasure.

Dr. Bell, in his "New Tracks in North America," says:

About six miles south of Fort Union is situated what, even in a civilized country, might be called a model farm. Mr. Kronig, the owner of this farm, came to the conclusion, from his own observation, that the rainfall along the base of the mountains was quite sufficient to supply artificial reservoirs from which tracts of land could be successfully irrigated. Notwithstanding the chance of such an experiment turning out a costly failure, he set to work, and has formed on the open plain two or three lakes or reservoirs, from which he now irrigates 2,500 acres of land. I bathed in one of these lakes in passing, went over a fine house he was building near it, and saw with pleasure the groves and avenues of young trees which he had planted, all thriving beautifully. The yield last year was an average of 35 bushels of maize, 40 of wheat, and 50 of oats to the acre. He is now a rich man, and hopes soon to have another lake and several hundred acres more land in good working order. He also states that he feels convinced that the rainfall has increased since he commenced to irrigate and form the lakes.

DIFFERENT MODES OF IRRIGATION.

There are several different modes of irrigation, and each of them has its peculiar crops and lands to which it is best adapted: 1. Bedwork; 2. Catchwater; 3. Warping; 4. Flooding; 5. Subterraneous.

Bedwork irrigation.—This is done by a series of hatches or sluices in the main ditch, on either side, opening into lateral branches, generally at right angles, and much smaller in size than the main, and generally, though not necessarily, at regular distances from each other; the land between each forming planes of sometimes 30, 40, or 50 feet each, with a water-branch running down their slopes, upon the old ridge and furrow principle, though the draining-branch of the feeder-ditch is slightly more marked than the old shallow furrow. These planes or ridges must vary in width and extent, according to the necessities of the case. If it is a soil hard to irrigate and hard to absorb, they must be smaller in measure across them. If the soil absorbs moisture readily, a longer distance across them will be sufficient. The crown of the ridge should not be over 15 inches higher than the furrow. These lateral branches must all be carefully regulated as to the quantity of water necessary to effect the object, and, if possible, not have any waste or surplusage when the object is accomplished and the lowest point properly watered. A careful farmer, who has executive ability and understands the principle, can so regulate the water as to have scarce any surplusage, which is a very great consideration in dry localities. Care must also be taken that the surplusage, if any, should be carried off immediately, by proper drains, as standing water on crops is quite as disastrous as no water at all. Bedwork irrigation, however, will not pay in Colorado, because the land requires beveling and so much expense to be laid out upon it to prepare it for the water. The best irrigators there have entirely given it up, and prefer a medium plan of embodying the catchwater and flooding modes.

Catchwater irrigation.—This is carried on upon quite a different principle. Lateral branches are used from the main ditch, as in the bedwork plan, but not in such numbers. Only one hatch and lateral is ordinarily used for one class of altitude slope or declivity. The water is taken from the main and passes down the slope a short distance, then takes a turn horizontally along the side or face of the slope, and sometimes parallel with the main ditch, continuing to the farthest point of the slope; it is then let down to a lower point, and returns on a lower parallel, say 20 or 30 feet, to just below the starting-point; thence it again doubles at a lower point, and repeats the process until the whole of the water is exhausted or the land irrigated. This process is carried on at different places in the field, according to the topography, contour, or profile. If there is one locality or one description of crop which needs more water

than this plan gives, the water in the channel can be stopped or dammed up by sods or little board sluice-gates, and the water made to run over the edges and flood the neighboring area, the next parallel below catching the surplus. It is not sound policy or economy to dam up the main ditch in this manner, which should be used as a head-main and source of supply alone.

Another plan can be adopted, and is usual in Colorado, to construct laterals down the slope from the main ditch, with diagonal furrows, about every four or six feet, more or less, as circumstances may require, to carry the water on either side of the laterals. In this case, a mere plow furrow is sufficient, and is temporary, being plowed every year, and locations changed as the experience of the farmer may determine. Another plan is to throw laterals from the main ditch down the face of the slope, and draw a harrow in various directions from the laterals, continuing the teeth-marks with the grade of the slope. This is a very good arrangement, and perhaps is better than flooding for ordinary crops, as the little rivulets caused by the harrow-teeth can be better controlled than by flooding, though for permanent, sound, compact, close old grass sod, the flooding is preferable.

Flooding.—This system is very commonly used in connection with the catchwater plan, and is really the very cheapest and easiest understood of either. It is done by closing the laterals with temporary dams or boards, and flooding the water over the edge. This is as cheap as any of the systems, and finds much favor, though great caution is necessary, as, if the slope of the ground is too heavy, washing of the soil and the seed with it may result. This mode by some is called terrace-work, and Governor Hunt at Denver has practiced it to some extent on clover, with admirable success. Another kind of flooding is by letting a body of water from one side of a river run all over a low piece of land, and letting it off into the parent stream at a lower point.

Warping.—This is applied to lands submerged with water, and is scarcely ever used, except on the seaside, where the tides can be employed. It is done by embankment of the land, and letting in the water; allowing it to stand until the sediment or warp is deposited.

Subterraneous irrigation.—This is done entirely by letting the water into deep drains, or ditches, to reach down into the sub-soil, and is admirably adapted to a very dry climate, and for crops which extend very deep, as it does not appear on the surface, except by absorption or upward percolation. This kind can be used any time in the day, when the sun is ever so hot, and it does not scald the plants like the other systems. The ditches are usually made the same as underdrainage, by brush or large stones to fill the ditch, allowing the water to soak or seep through the soil. The only difference between subterranean irrigation and underdraining is in the location of the ditches; in the first you place them on the highest, and in the latter on the lowest point of the land.

IRRIGATION AS A VEHICLE FOR FERTILIZERS.

Water can be used as a vehicle for various fertilizing mixtures or substances; a stream of water through the stable, hennery, piggery, back-house, or cow-pen, may be used in conveying food to farm-plants. Spring or well-water should never be directly turned upon seeds or plants, unless moderately warm, or of the temperature assimilating to river-water or rain. Cold well or spring water should be exposed in a reservoir to the action of the sun, so that it may acquire a temperature equal to the atmosphere and the earth.

A good liquid fertilizer for plants may be made by mixing twelve gallons of water with four pounds of Peruvian guano, and allowing it to stand for twenty-four hours. This may be applied to flowers in pots. The guano administered in a dry state might kill the plants. The same guano will serve three times, each time being covered with twelve gallons of water.

The Germans have a popular proverb, that "he who has water has grass." The irrigators in the vicinity of Northern Spain need no manure where they use water by irrigation. In that section the water is loaded with the abraded deposit of the granite rocks, held in solution until, by warping and flooding, it is deposited on their farms. Near Antwerp, the meadows are never manured, but highly improved by the application of water alone. In the manipulation of his soils the farmer can take advantage of knowledge gained by study of their peculiarities and experience in their treatment. If he has a too stiff and heavy clayey soil, he may apply a thin layer of calcareous or silicious sediment, or warp. If it is too light, sandy, and lacks compactness, a solution which will give a deposit of clay will prove advantageous. Water in such cases must be used as an infiltrater and not for superficial deposition alone; where water is used as a fertilizer as well as a refreshing medium, reservoirs must be dispensed with, unless the intention is to replenish the bottom of the reservoir for the ultimate object of reclaiming it for farm or garden purposes. Water is prized for irrigation purposes just in the ratio of its amount of extraneous matter contained in solution. River and swamp waters are always preferable to spring waters for other reasons besides fertilizing. Spring waters are always colder than river water, and, therefore, not so well adapted to cereals and small plants particularly. To test the necessity of a proper temperature for irrigating water, let the gardener and farmer try the experiment of watering plants of the same kind, part of them by warm and part by cold water, and they will easily see what a difference there will be in favor of the warm water.

On the Ganges or Nile, it is usual to make dikes or embankments to keep the waters confined within certain limits, in order that they may have sufficient time to deposit their alluvial sediment. This is known as "warping" all over the world. In Egypt these deposits are alluvial in their character; in England and Germany they are chiefly salt and marine deposits.

The amount of matter which comes down from the Rocky Mountains is immense, and cannot be estimated; and the same process has been going on from time immemorial. How, then, can the great plains ever be exhausted, if the farmer will use the waters that come heavily laden with the nutrition which furnishes the every-day food for plants?

Irrigation cannot be complete without proper judicious underdraining. It requires good subsoiling, if the depth of soil will admit it, and thorough underdraining. Simple water-furrows are not sufficient in every instance. The water must be carried off as effectually and with as much care as was devoted to bringing it on to the land. Water, standing in pools on the land, should be immediately got rid of. In the winter such pools are apt to accumulate; then the plow and the spade should be brought into requisition, even if it is in mid-winter, upon winter crops.

Meadow grass has, as yet, received but little attention in Colorado, simply because the farmers there have tried the European plan of very heavy watering. It must be borne in mind that a tenth part of the water used in England is not required in Colorado, for the reason that

the compact turf, the growth of many years in England, will bear a continued flooding. If the same amount was used on the thin grass of our plains it would kill it out, the soil being more porous and the plants not growing so closely together. The English turf-sod is almost impervious, and it requires a long time ere the roots of the grass receive the nourishment necessary. In time, when the farmers of Colorado have made a rule to plant timothy and the grasses peculiarly adapted to irrigation, they may then with impunity use the quantity of water recommended by English and Italian irrigators.

HOW MUCH AND WHEN TO IRRIGATE.

The best time to irrigate is early in the morning, before the sun acquires very great power, or in the evening, when it is about to go below the horizon. A good time to water land is when a cloud comes up and you expect a shower. In nine cases out of ten the shower does not give all the water needed, so the work will not be uselessly expended. In the spring the work of irrigation commences in earnest. It is not necessary to use water in May as a fertilizer, but simply to moisten the earth as a germinator. Probably it may not need any water if a large quantity has fallen during the winter. The water which comes down from the mountains then is the melted snow and surface water; but in June and July the sedimentary deposits are running, and the streams are laden with fertilizers, which decrease as the winter approaches and the streams are lower. When the waters are laden in this way and the crops want the fertilizer, the farmer should irrigate by flooding; and in the fall, when the streams are limpid, it should be done by catch-work. The soil should not be kept continually moist; dryness on the surface does not always indicate dryness below. It will not hurt crops to let them get occasionally partially dry. Some crops require more water than others, and some will bear very little at a time; twenty-four hours' watering will not hurt wheat and other small grains, nor beans, peas, turnips, and rutabagas; beets and cabbages will not bear more than twelve hours of continuous moisture, as their root-fibers are so delicate that they soon get choked up and rotten. In such cases they will sometimes shoot out more fibers, but often they will die, and a retardation of growth is certain. It should be continued in August, as in that month the rainfall is usually less; in September also, and, in fact, until early winter, or the ordinary rains and snow appear. If an ordinary or sufficient quantity does not fall, it should be continued all the winter at intervals, as it prevents the frost from extending too deep into the soil.

THE ECONOMY OF IRRIGATION.

The history of irrigation warrants the statement, beyond all contradiction, that without it, in certain dry climates, no successful crops of any kind can be raised; and, also, that in ordinarily humid climates, all over the American continent, there occur periods when droughts are experienced and the crops are almost a complete failure, while with irrigation properly and industriously conducted, double the yield attained without it can be assured. It is, therefore, logically true that irrigation, properly conducted, either in a dry or humid climate, may be decidedly profitable. The testimony of California, Colorado, New Mexico, Missouri, Pennsylvania, Massachusetts, and almost any State and Territory of the American Union, places the matter beyond dispute. The Pacific Rural Press, of California, in speaking of the Woodland Ditch Company, which is but the mirror of hundreds of similar institutions, says: "All the grain irrigated by this company will produce

a fair average crop. The same grain, without irrigation, would have been an almost total failure. The cost to the farms for water is about $4 per acre, and the grain will probably be worth $25 to $30."

In Colusa County, California, the alfalfa or Chili clover, probably lucerne, produces ordinarily, without irrigation, three tons per acre at each cutting, twice a year; but, with irrigation, it reaches to three tons three times a year. Mr. Safford, of Hope, Maine, says he has 40 acres of meadow which he irrigates from a small stream. He does not allow water to go on it in the winter, as it kills the roots of the grass. Of two fields, side by side, one without irrigation yielded 400 pounds to the acre; the other, irrigated, from two to three tons. He uses no manure.

In some localities, but not usually in Colorado, the charge for water is $1.50 per inch, which astonishes parties who come from the East, and wonder how a farmer can possibly afford to pay such a price for the irrigating season. It is easily explained. The employment of irrigation doubles the product. Where, in the United States, except in Colorado or California, (as is popularly claimed,) is the average yield so high as 26 or 28 bushels of wheat to the acre? If they did not irrigate, the crops would yield probably only 12 or 20 bushels, as in Iowa, Illinois, and other portions of the favored West. If they have to put more labor upon their farm, it yields immensely more in proportion. A farmer in Colorado, who for seven years has steadily stuck to business and worked only half as hard as the slaving husbandman of the older States, will be found to be wealthy, and not actually compelled to work another day. In the East it takes thirty years to acquire a competency, which the Colorado farmer secures in seven or ten years. There is no necessity for a farmer to remain poor in Colorado, even if he starts without a penny.

In Boulder County, Colorado, the cost of irrigation is not more than 5 or 10 cents per acre, outside of a share in the works, costing, probably, from $50 to $100 each. The cost of repairs in the main ditch is paid by a tax on the shareholders, which usually amounts to $5 per annum; this, added to the interest for money, is the actual cost of the water. The lateral branches are owned by each individual, and built at his own expense, which amounts to but very little, and that only in labor when the men and teams have nothing else to do. The representation that irrigation is expensive is a mistake calculated or intended to depreciate the country and institute unfavorable comparisons with eastern agriculture. In any country which is subject to occasional drought, a crop cannot be assured without irrigation; with it the yield may be doubled. The expense of irrigation is probably less by 50 per cent. than average loss by drought in any State in the Union. The rain-fall is not enough in any section of our country at all seasons of the year to meet the want of the crops. With irrigation, the quality of Colorado wheat is far superior to the wheat of any Eastern State. With irrigation, the quality of every specimen of wheat sent to Colorado has been wonderfully improved—a fact substantiated by the reports of this Department.

Mr. G. H. Church has a ditch whose terminus is eleven miles from Denver, on the Boulder road. It was taken out from Coal Creek, at the foot of the mountains, and runs 10 miles east to his farm. The average fall is 13 feet to the mile—too much. The size is 5 feet wide and 1 foot deep; cost about $1,000, reckoning team and man at $4 per day. This ditch is a proof of the efficacy of the reservoir system. It does not run enough water from the head for the entire season, but is kept running all the time while water can be obtained from the head, and stored in a lake or reservoir, to be used as a reserve in dry seasons. He has one lake

from which he draws his irrigation water, but he has another which he keeps for fish-breeding, and has stocked it with sun-fish and cat-fish from the Pancross Lake at Valmont, and they are multiplying enormously. Mr. C. is going to the States in the spring to bring out some black bass to stock another lake. He thinks that all through the season, such a dry season as 1871 for garden and farm produce, it cost him for spreading and manipulating the water on 40 acres about $1 per acre; in ordinary seasons it will not cost half that amount. The lake is one and a half miles from his house. The irrigation lake is about 1,000 to 1,200 feet square. This water supplied last year 40 acres of land, leaving plenty for fish and for watering stock.

Mr. Magnus says of the Upper Platte and Bear Creek Ditching Company, in which he is a shareholder, that it costs him about $30 to $35 per annum for repairs, and his share of water is about 144 square inches, which irrigates 140 acres of land, comprising about equal quantities of bottom land, second bottom, and upland. It costs the person near the head of the ditch only about $5 or $6 per annum, and the last person on the line of the ditch it costs about $50 per annum. This ditch is five or six miles long in Arapahoe County, though it commences in Jefferson County, 16 feet wide at the head and 20 inches deep, tapering gradually as it passes down the line. Mr. Everett, on the divide between Clear Creek and Platte, says that it costs a great deal less in proportion for water to irrigate 160 acres than it does for 40 acres. To illustrate this in his own case, he says he irrigated 180 acres of land with 90 inches of water, and it is generally conceded by the whole community, in his neighborhood, that 30 or 40 inches is required to irrigate about 40 or 50 acres. He says he has always averaged over 25 bushels of wheat to the acre before this year. Last year (1870) he had 50 acres, and averaged over 25 bushels per acre. This year his average on 120 acres was 16 bushels to the acre; but some of his crop, not being irrigated, was so poor it was never harvested, and about 12 or 15 acres not cut at all. He says, if the farmer is well situated for irrigating, and can employ his water to advantage, 25 bushels per acre of wheat is a very low average.

It may be said, after reading the statements as to the cost of irrigation, that there is a discrepancy per acre. This can be accounted for thus: Where the amount extends to $1 per acre, or in that neighborhood, the farmer hires the water of a ditch company, who realize a large profit on the investment. The mere manipulation of the water, when the main ditch is built, will probably not cost above 50 cents per acre for 160 acres, but rather more in proportion for 40 acres. Platte Water Canal Company charge about $3 per inch; Table Mountain, $1.50; Farmers' Ditch, Jefferson County, $1.50; Ralston Creek Ditch Company, $3.

Mr. Meeker, of Greeley, gives, in the Greeley Tribune, an estimate of the cost of canal No. 1, as follows: Length of surveyed line, thirty and a half miles; completed length, twenty-six miles; cost of excavating 107,949 cubic yards, at 21 cents per yard, $22,669.29; head in Larimer County, section 11, township 6 north, range 68 west; terminus in Weld County, section 15, township 6 north, range 65 west; distance from head to terminus, (air-line,) seventeen miles; lost by sinuosity, 53 per cent.; total fall in twenty-six miles, 75 feet 9 inches; fall per mile, about 3 feet; cost per mile, $872. Irrigation is found on a grander scale of expense in the older countries of Europe; one may scarcely find a system there more economical, or more subservient to the wants of the masses, than is found in the little community of Greeley. The lack of an equal

humidity in the atmosphere with other sections, is the cause also of a lack of a great mass of those pestiferous insects well known in the United States, and the disadvantage in one case becomes an advantage in another. The lack of moisture on the plains cures the grass into hay, while the excess of moisture on the eastern seaboard, and even in the garden of the Mississippi Valley, saturates and rots the grass, which is lost to utility for everything but manure, when left on the ground during the winter.

DITCHES IN COLORADO.

According to the most authentic information, without an exact and complete examination, it is estimated that there are about four hundred miles of main irrigating ditches in Colorado. General Lessig, surveyor general of Colorado, estimates 10,000,000 acres of land as susceptible of cultivation in the Territory, and says, "The amount is only limited by the facilities of irrigation." There are many hydraulic mining ditches which do not properly come in the province of irrigation, and are therefore omitted in this calculation.

The Platte Water-Canal.—This canal or ditch was commenced in 1859, and is twenty-four miles long. Its cost was said to be, at the time it was built, $100,000; but this is exaggerated, as it can be duplicated in 1871 at $25,000. It is estimated that 50,000 acres are covered by this ditch, though probably not more than 15,000 are under cultivation. It commences near the mouth of the Platte Cañon, on the line of Douglas and Jefferson Counties, and extends northerly partly across Arapahoe County, to a point about two miles east of the city of Denver. Its original width at the head was about 10 feet, and depth 2 feet, gradually decreasing in size as it nears the city. The fall is various; in some places 6 feet, and in others as low as 18 inches. This ditch was constructed in a very unscientific manner, from lack of facilities, and, in consequence, a large amount of water is lost. The company are enlarging the volume of the ditch to meet the requirements of the city of Denver for irrigation purposes, and the width at the head is now 30 feet, with a depth of 3 feet.

[The compiler deems the great capacity of the new works unnecessary, as well as calculated to give the impression that the entire volume of water in the river will be monopolized, and tending to discourage the work of irrigation in the new West.]

Table Mountain Ditch Company.—This ditch is taken out of Clear Creek on the south side, about one and a half miles from Golden City. Originally it was 6 feet wide at the bottom, 2 feet deep, and from 12 to 15 feet wide at the surface. Head-gate 12 feet wide, with partitions between waste-gates, 10 feet wide. The fall is about 19 feet to the mile in the first two miles, which is very much too great a fall in any ditch whatever; and, in consequence, it is gradually washing and degrading its banks every year. It is nearly twenty miles in length. The south branch is about two and a half miles long, and is taken out eight and a half miles from the head. The charge is $1.50 per inch per annum, with a pressure of about 3 inches, making the cost of irrigation about $1 per acre. It was built in 1864 and 1865, and cost about $15,000; but everything then was very much higher in price than now; probably it could be built for $8,000 now.

The Farmers' Ditch.—This ditch leads out of Clear Creek, and is intended to irrigate 30,000 or 40,000 acres. Its head is one and a half miles above Golden City; in size it is 6 feet wide at the bottom, 8 to 12 feet on the surface, and 18 inches deep. In length it is eleven miles, and runs down on the ridge and uplands between Clear and Bear Creeks

and the Platte River, toward Denver. The probable cost is $10,000; it is not yet completed the whole length. The charge will probably be the same as the Table Mountain Water Company, $1.50 per inch.

Canal No. 2, of Saint Louis Western Colony, Evans, Colorado.—Mr. W. H. McDonald, the surveyor of the canal, furnishes the following items respecting this improvement: The main trunk will be nine miles long, from a point on Warren Batchelor's farm on Platte River, to a point four miles below Stover's Ranch, on Denver Pacific Railway, with a falling grade of 7 feet per mile. The canal is 10 feet wide on the bottom, with slopes of 1½ to 1, giving an area of water section of 53.37 square feet. At the end of the first nine miles the main trunk will be divided into two branches; each branch will be 7 feet wide on the bottom, slopes 1 to 1, fall 6 feet per mile. The east branch will cross under the Denver Pacific Railway to its east side, thence northeast twenty miles parallel with the railway, and along the western base of the divide between Box Elder and Platte; the west branch will run parallel to the Denver Pacific Railway on its west side, and generally along the old stage-road from Denver to Atchison and Saint Joseph, Missouri, at a point near to and east of Mr. Holon Godfrey's ranch; this branch will cross to the east side of the railway, thence northeast to a point south of Evans, its terminus for the present. It will be eleven miles in length; making a total length of forty miles, at an estimated cost of $23,750, covering an area of five townships of land, or 115,200 acres. The colony also constructed the past season six and a half miles of canal to supply the town and irrigate residence and garden lots; also two and a half miles of street ditches, costing about $7,000. This canal was constructed also with a view to milling purposes. The colony proposes to construct another canal, No. 3, to be taken from Big Thompson, 7 feet on bottom, slope 1 to 1, and nine miles in length, to cost $8,000, in time for spring crops.

ALKALI LANDS.

In many parts of Colorado there are patches scattered here and there of what is known as "alkali lands." They are common all over the Great Plains on both sides of the Cordilleras, and are a great bugbear to the farmers, who generally suppose that nothing can be raised upon them; but this is wrong, as in Colorado places where alkali abounds raise magnificent crops. The whole of the Great Plains is, in a great measure, saturated with it. The Commissioner of the General Land Office, in his report to the Secretary of the Interior for 1868 and 1869, says:

> The table-lands afford excellent winter pasture in the white sage which they produce, but are of doubtful capacity for the raising of cereals by irrigation. The alkali lands are beyond the power of reclamation by any means now known to man.

If the Commissioner had resided in Colorado, or had examined the matter critically in person, he would not have hazarded that statement. Practical experience has demonstrated that the sage-brush land is capable of raising large crops of timothy, clover, alfalfa hay, and the general cereals. In Colorado the produce of alkali land has been as high as 70 and 80 bushels of wheat to the acre, and it can easily be made to yield 40 or 50 tons of beets per acre.

A gentleman, through one of the agricultural papers, speaks as follows in this connection:

> In traveling across the continent last summer, we began to hear of alkali, when we were a few hundred miles west of Missouri, and the evidences of its presence in the soil and in the water grew stronger as we advanced, till, in the Humboldt Valley, we ran

for hours through the alkali flats, a region made hopelessly desolate by the excess of noxious elements. The action of air and rains has been to dissolve the salt and remove a part of it, carrying away the chlorine, but not the soda nor the magnesia. In Utah they have had a long contest with what they call saleratus land. Time, cropping, and water are the remedies for the soil. Mr. Meeker, in his prosperous colony, spoke of finding some, but not enough to be mischievous; besides, he draws his water from the snow-clad peaks of the high mountains one hundred miles west of the plain, where Greeley is situated, and needs no wells. Irrigation is the sovereign remedy where water can be obtained. The bitter stuff can be washed out. Probably the best way in Kansas would be to plow these spots in a ridge furrow late in the fall, and let the winter rain leach through the earth.

An ox, bloated with alkali on the plains, can be cured by the administration of fat bacon or vinegar. Governor Gilpin tells us that when he went across the plains with the Doniphan expedition, he served double rations of vinegar to the soldiers, and they experienced none of the effects usually known from drinking the alkali water. Onions, also, are a specific, and the pioneer feels an absolute longing and desire for onions and vinegar in preference to any other food, on crossing the plains. To thoroughly cure alkali lands, in the first place irrigate them, then well drain them with good underdraining of brush, round stones, or tiles and deep subsoiling; this will wash the alkali quite out of the soil and make it clean, mellow, and free from a deleterious quantity of these salts.

In irrigating, of course the farmer will take care that he does not add more alkali to his land in large quantities. It is deposited by precipitation and evaporation, but a current of water will remedy the trouble very shortly.

QUESTIONS ON IRRIGATION.

The following questions on practical irrigation, propounded through the columns of the Greeley Tribune, are thus answered by our correspondent, Mr. Stanton:

1. Does a dam across an irrigation canal have any effect on the water above the first ripple?

The reaction of the water consequent upon the obstruction offered by a dam is called "regurgitation," and is effected in extent up the stream in the ratio of the height of obstruction. The surface of the water is, however, raised a little above the level by the action of the volume above coming in sudden contact with the still water. This swell backwater, or regurgitation, sometimes should be allowed for so as not to overflow a neighbor's land. It has been contended that the stagnation of the water extends to a sensible height above the horizontal line of the regurgitation from the dam or sluice, or any other fixed obstacle. This is accounted for by the compression or closer adhesion of the particles of the water. This has been for many years a subject of philosophical discussion among hydraulic savans, and is not even yet fully established as a dogma.

2. Will more water pass into an *acequia* by placing a board diagonally and upward across the lateral than by making a dam straight across?

No. You cannot get more water through a channel, from a lateral, than the volume contained in it. If you confine the water, and divert it from its natural course, you may compress it into a smaller space, but the same quantity will be found below the compression as is found above it. A funnel-shaped ajutage, or channel, will discharge the same amount of water after the narrow portion of the funnel is passed. In illustration: Let an orifice of one inch square be made in a board, with a head of water six inches above the orifice; more water will be discharged than if the water was only level with the upper edge of the orifice;

therefore it is always considered that more than an inch of water is passed under those circumstances.

3. Is it not cheaper to sow wheat and all small grain in drills, with furrows for water-courses between; that is, granting the crop equal, will not the greater facility afforded by irrigating in furrows compensate for the extra labor of drilling?

In the first place, I cannot believe that flooding grain is so good as allowing the water to run in channels between the drills. It is not best to allow the water to touch plants above the ground if it can be avoided. It is unnecessary, certainly, as the nourishment to the plant is derived from the roots alone. By drilling grain, with irrigation, you can have a better control of it. I think that "granting the crops equal" is not a fair supposition, as I cannot imagine they could be so. Flooding over a standing crop must injure it more than by letting the water down on either side of the plants. A crop *might* be irrigated by flooding without sensible injury, but it would require much greater care to prevent the plants from being washed out. You can certainly with the same labor irrigate more land by drilling grain than otherwise, as the quantity of the water above must be excessive, almost dangerously so, for it to reach the lower part or bottom of a long slope.

4. Is one time in the day better for irrigating than another?

This all depends upon the system of irrigation that is used. If you use subterraneous irrigation, like underdraining, you can irrigate at any time in the day or night; but it is always more expensive, and where the land is so cheap as in Colorado there is no necessity for it. By the other systems, crops should never be irrigated in the heat of the sun. When a storm is coming, and clouds obscure the sun, then would be a good time to irrigate. Nine times out of ten the showers are not adequate to give all the water needed. Such an opportunity should never be neglected. Early in the morning, though the sun may be shining, is a good time, as it is not strong enough to scald the plants. In the evening, also, and all through the night, would be a proper time to irrigate; the extra value of the result will justify, even if it does cost more. It might be possible, in crops planted in rows or drills, to irrigate in the heat of the sun; but it would require great care to prevent the water from touching the plants. I am inclined to believe that if the water can be kept from moistening the plants the increase of temperature over the heated surface would do good.

5. How often should a garden be watered, and do some kinds of vegetables require more water than others?

The quantity of water depends upon the kind of soil, the amount of rain-fall, the description of the subsoil, and the kinds of plants to be watered. Some vegetables are more tender that others; some have such minute tendrils in their roots that complete saturation for twenty-four hours would rot them entirely. This question can be met only by the good judgment of the irrigator, without going through the whole catalogue of plants, grain, and vegetables. Again, crops may be watered twice a week; sometimes, according to the circumstances named above, they may want it only once a week; sometimes possibly once a fortnight; it is impossible to prescribe for every patient or every case; all depends, as the doctors say, on the diagnosis.

6. Over how many rods broadcast can water be made to flow with advantage, and what is the limit of distance where the grain on the upper side of the field will receive positive injury?

This question can be answered only by the farmer himself, as the limit is governed entirely by the slope or declivity. If the land is nearly level and the water is not in danger of degrading the soil when it leaves

the lateral, the water can be carried over it for a very long distance. But if the slope is a heavy one, common sense would deem it the height of folly to throw a heavy sheet of water over it, or even sufficient, perhaps, to carry the water over five or six rods, or even less. The kind of seed must also be taken into consideration; light grass seeds must be very carefully flooded, if ever, on any kind of slope whatever. A strong, heavy sod of turf, like the English meadows, will bear a rush of water which would utterly ruin a newly planted grass-patch.

7. How much less water is required for land cultivated the year previous, and what, if any, is the increase of production in grain, potatoes, and vegetables?

This is a very important question, and involves more of careful thought than has yet been given to it. On sod-lands it is usual to calculate your crop about two-thirds less than can be ordinarily raised the second year; and in some cases very much less, though I have known, in Colorado, larger crops raised than ever afterward. This is due to the extra amount of good farming and good work expended upon it. The opinion is borne out by isolated cases of practice and experience, that if sod-land is plowed well in the fall and again in the spring, and plenty of water used, the crop will be equal in every case. The crop will be found to be graduated in the ratio of mellowness and thorough pulverization of the soil, and in the same ratio will be the amount of water required. Plants require aeration as well as moisture, and a baked soil will never allow a proper germination of any but the hardiest seeds. The expenditure of force required to break the crust of a harsh soil will result in dwarfed and truncated plants. Farmers generally settle down into the belief that sod-land will only raise a meagre crop, so they do not devote the care necessary; and, of course, the result only equals their expectation, and scarcely ever exceeds it.

8. What is the value of the gramma grass for hay, when irrigated, and is it likely that clover, timothy, and other tame grasses can be grown to advantage instead?

Very little is known about the irrigation of our native grasses in Colorado, and I have heard of no experience in the matter. But I am inclined to believe that, if a crop of clover and timothy were sown and harrowed in upon our wild grass-lands, that it would be the means of insuring a fine crop; when, if our wild grasses were irrigated as they now stand, the yield for a year or two would not be nearly as great.

9. Does the fertility supposed to be given by the water of an irrigating canal come from the soil through which it flows or from the mountain rock, or from both, or is it due in part to chemical changes, induced through the action of the air and sun, corresponding to fermentation?

I am satisfied that the chief, if not entire fertility of our irrigating water, coming as it does from the Rocky Mountains, and, as soon as it debouches on the plains, rushing over a bed of clean sand, is caused by the disintegration and washing down of the properties contained in the rocks. The fertilizing agents which are contained in the water can come from no other source, as the water of our canals does not run over alluvial soils until the main ditches are opened; and then the distance is so short that no large accumulation of its properties could result from it. The beds of our alkali lakes, as I view them, are but the accumulated deposits of many, many years of filtering and precipitation, as it were, like the accumulations of sediment on the filtering-paper in the funnels of our laboratories.

10. If we could choose, would we or would we not prefer rain, as it comes in the States, to irrigation?

In answering this question, it requires to be prefaced by a half apology to the farmers and residents of older countries, in offering an opinion which is so much at variance with all their old pet prejudices and preconceived notions of the relative value of the two sections. The answer is, unhesitatingly, that our people, with scarce an exception, would not prefer the rain, as it comes in the States, to irrigation in Colorado. There is no uncertainty in raising a crop with irrigation, properly conducted, with even a very ordinary amount of hard, common sense, and without any scientific or engineering ability whatever. There is such a difference between the two systems, in view of their products, that there can be no dispute about it in the minds of any who have tested both.

A GREAT WESTERN AMERICAN CANAL.

Some of the most important works of both ancient and modern times have been accomplished in all the great divisions of the globe, from east to west, north to south, in every one of the old monarchies, in connection with irrigation and water-supply; and these works were conducted under the auspices of the Government.

Mr. Stanton favors, in the suggestions following, a grand enterprise for the reclamation of the "Great American Desert," and says that, with very few exceptions, every foot of land lying in Colorado and Kansas, known on our old maps and the maps of Europe as the Great American Desert, between the base of the Rocky Mountains and Kansas City, on the Missouri River, is susceptible of irrigation.

From the head waters of the Platte River down to Kansas City there is plainly a continuous water gradient, as is evident by the Platte River itself, which empties into the Missouri. The altitude of the head-waters of the Platte is 9,600 feet, while the altitude of Kansas City is only 648 feet above tide, thus making a difference of 8,952 feet fall. There is certainly, then, no point upon the great grassy plains of Colorado and Kansas which is above the waters of the Platte River. Take a lower point of the Platte River, in the interior of the mountain chain, from the calculations of Professor Engelmann and Dr. Parry: They give 9,153 feet of altitude; eleven miles lower down, 8,657 feet; three miles lower, 8,435 feet; six miles lower, 8,028 feet; Plum Creek, which is an affluent, and joins the Platte about fifteen miles south of Denver, these gentlemen say, is 6,409 feet. The mouth of Plum Creek is at least six miles from the Platte Cañon, where the river debouches upon the plains, and where the Platte becomes quite a large and important stream. At the cañon it is at least 6,000 feet above sea level. We will take this as an objective point or base of calculation, because we know, and it has been abundantly demonstrated, that the river can be tapped there, as a ditch is now running twenty-four miles from thence round to Denver. There is no point on the plains anywhere in the area of Colorado and Kansas so high as this initial point at the mouth of the cañon.

A preliminary survey and approximate levels have actually been run from this place in an easterly direction across Plum Creek, Cherry Creek, Cole Creek, Box Elder, Kiowa, Bijou, Beaver, to the head-waters of the Republican; and the fact of its practicability along this route, keeping along the Kansas Pacific Railway, and covering their lands, is beyond a doubt. From this place, which is near the line of Colorado and Kansas, there is no point higher in the whole area of Kansas, proving that Kansas lands are as susceptible of irrigation and of a water gradient as are those of Colorado. If the supply of water from the Platte River should at any time not prove sufficient, all the streams which the canal may cross by aqueduct, sluice, tunnel, or otherwise, can be made subservient as lateral

branches, supply affluents, or feeders. All the streams are torrential in their fall, and in every case a mile of feeder will be all-sufficient to take from those streams as much water as is required to keep up the supply in the head main.

Again, a doubt may arise as to whether there is enough, or indeed any water, in these every one apparently dry streams. If any person will take the trouble to dig down in the bed of these streams, they will find abundance of water at a very little depth. If the water is there, and above the level of the head-main, it can be used as a supply-feeder. If a canal, then, is constructed, covering the whole of the lands of the Kansas Pacific Railroad, it will enhance the value of those lands at least 50 per cent., and in most cases, especially in Colorado, 100 per cent., as it is a well-known fact that every acre of land covered by a ditch of however limited a size is worth at least $10 per acre.

A grand work has been accomplished by British engineers: at an enormous expense, borne entirely by the government of India, (and amounting, if we remember correctly, to ten millions of dollars,) a dam was thrown across the great river Godavery, which enters the Bay of Bengal on the Coromandel coast; and thus not only was the river itself made navigable, but thousands of square miles of fertile land were supplied with water for irrigation. The mere increase of revenue from the districts benefited by that great w rk is reported to have more than compensated the government for its outlay. Should the necessity for similar works ever arise in this country, American engineering skill will be found equal to the task of constructing them. When the population of the North American continent shall have increased to hundreds of millions, even our deserts must be utilized. The system which, on a small scale, has made a garden at Salt Lake City, where once scarcely a shrub grew, can be indefinitely extended. The engineer, to whom nothing is impossible, will demand merely the size of the reservoir desired, and the millions to be spent in its construction, and he will undertake to irrigate all Frémont's Basin from the melting snows of the Sierra Nevada. Such tasks as those of irrigating the arid plains of Western Texas or the valley of the Rio Grande would be mere ordinary performances, and the day may not be very far distant when, under laws adapted to the object, American energy and capital will undertake such works as profitable private enterprises.

This great work of the reclamation of the Great American Desert will not cost a hundredth part so much as the works of European engineers, and will put the gigantic Suez Canal and its compeers in past ages into the deepening shade. It remains to be seen whether the Congress of the United States will place alongside her magnificent work of uniting the Atlantic and Pacific with an iron band the equally magnificent work of wiping out from the map of the world the bar-sinister upon her escutcheon—the "Great American Desert."

IRRIGATION SYSTEMS OF DIFFERENT COUNTRIES.

It has long been evident that the earlier estimates of the productive capacity of the trans-Mississippi region were fallacious, ignoring important facts and principles which are now coming into general notice. The errors resulted from the hasty generalizations of limited farming experience in the older States, applied to new and imperfectly understood conditions of soil, climate, topography, and chorography. Later and

more reliable reports indicate a far more hopeful class of physical conditions for the development of civilization in that vast region, embracing 2,000,000 square miles, or two-thirds of our national territory prior to the acquisition of Alaska. Thither the centers of population are rapidly shifting; the increase of civilized population west of the Mississippi, during the past decade, was at the rate of 52 per cent., while that of the whole country was but 22 per cent. The capacity of this region to support a large population is, then, a matter of profound interest, and should be definitely ascertained and developed. The public will receive with satisfaction the reports of later observers, whose better opportunities have enabled them to make more intelligent observations. In Dr. Hayden's report of the late geological survey of Wyoming Territory, Professor Cyrus Thomas, whose special function was the observation of the agricultural character of that region, gives the following general estimate:

> Startling as the statement may appear to those who have swept across the continent along the barren-looking track of the Union Pacific Railroad, I assert it as my firm conviction that there are but few lands in all this portion of this country that are really unproductive; that wherever there is soil, if water can be applied to it, it will be found rich in all the primary elements necessary to the production of useful crops of some kind. Without water, as a matter of course, it cannot be made to yield, and the crops produced will vary with the climate; but these facts do not affect the position I take in regard to the primitive fertility of the soil.

In studying the agricultural capacity of this region, this writer says it is "necessary to lay aside, to a great extent, all our ideas of agriculture based upon experience in the States." He finds not only climatic and topographical peculiarities, but also "thermometric and hydrometric conditions bearing no such relations to vegetation there as here."

> Hence, he argues, the *criteria* by which we judge of the fertility and productiveness of the soil, and of its adaptation to given products, (except, perhaps, the strictly chemical test,) do not hold good here. The pale appearance of the soil, the barren look and stunted growth of a spot, are by no means conclusive evidences of its sterility, for the application of water may show it to be rich in vegetative force. Plants which are considered as incompatible in other sections are here found growing side by side, while others usually associated are here never, or but seldom, found together. Even the constants—latitude and elevation—cannot always be taken as true indices of temperature and vegetable life, on account of strong counteracting local influences.

The grand fertilizing element that is to unlock the latent resources of productive power throughout this region is water. Among a large number of instances of its successful application, Mr. Thomas states that the little valley of the Upper Arkansas, "nestling high among the snow-covered granite peaks of the Rocky Mountains," and "covered with the rough local drift from the barren metamorphic peaks around it," yields rich crops of cereals, potatoes, &c. "The fossil-bearing deposits in the Bridger Basin, on account of their worn, washed, and barren appearance, have been compared with the *Mauvaises Terres* of Dakota, and have generally been considered by travelers as utterly worthless in an agricultural point of view; yet the productive farms along Smith's Fork will convince the most incredulous of the error of this opinion." All the hardier vegetables grow along the tributaries of Wind River. The garrison at Fort Saunders produce their own vegetables in abundance. Professor Thomas further states that "prolonged experiments have shown that even spots so thickly frosted over with alkaline deposits as to destroy vegetable and animal life can be rendered fertile and made to produce abundant crops." As a final illustration, he refers to the successful cultivation inaugurated by the skilled and patient industry of the Mormons among the drifting sands and basaltic hills of the Rio Virgin.

Facts of this character might be multiplied to show that the mountain regions west of the Mississippi, with artificial irrigation to supply the local deficiency of rain-fall, may yet become the sphere of a unique and productive agriculture. The question of fertility, then, resolves itself into one of capacity for irrigation. Where facilities for the easy application of water exist, local enterprise, with a trifling outlay of capital and labor, has already redeemed large areas till lately condemned as hopeless deserts. In other localities, however, the elements of the problem may not be so readily discovered. A wider range of facts and principles must be combined with professional engineering science and skill, in order to devise and execute a general system of irrigation. Some of the elements of this investigation are accumulating in books and periodicals constantly issuing from the press, in which different portions of the trans-Mississippi region are illustrated. But a systematic agricultural survey alone can reveal the fundamental conditions of such a general system. Many years ago the enlightened policy of the Government projected an extensive and elaborate system of surveys of this region, for the purpose of testing the feasibility of trans-continental railways. The interests involved in productive agriculture are at least equal in importance to the commercial considerations which prompted the Pacific Railroad explorations. The expenditures of a tithe of what those explorations cost, in the systematic survey of the same regions with reference to their agricultural resources, and especially their capacity for irrigation, would be justified by results no less valuable to civilization. The admirable reports of the geological reconnaisance of a portion of this Territory, conducted by Dr. Hayden and his associates, show that very great results may be secured by the judicious expenditure of a small sum of money. It is not to be expected, however, that the tide of immigration will await the slow movements of Government. The process of irrigation will be applied by private enterprise to particular localities, as the wants of increasing settlements demand, and results that might be readily and cheaply arrived at by a preliminary survey will finally be demonstrated in a series of disastrous experiments, such as marked the earlier history of mining industry in the same regions.

The trans-Mississippi region is traversed from north to south by a broad elevated swell or plateau, occupying the greater part of its area. The elevating geologic forces which caused this massive upheaval manifested special intensity along several anticlinal axes, piling up great mountain ranges and isolated peaks, which, in many instances, rise thousands of feet above the line of perpetual snow. The main crest of this general upheaval may be traced by an undulating line of summits, separating the east and west bound streams. This water-shed is the Rocky Mountains proper, sometimes called the backbone of the continent. It is the northward projection of the central branch of the Sierra Madre of Mexico, called the Cordillera d'Anahuac. It crosses the international boundary near the southeast corner of Arizona, with an eastward serpentine curve through New Mexico and Colorado, inclosing in its convolutions the magnificent peaks of the latter Territory. It finally trends northward, across the western portions of Wyoming and Montana. Its greatest general altitude is about the thirty-eighth parallel, where it presents no passes lower than 10,000 feet. To the northward the Union Pacific has been able to find no gap lower than Evans's Pass, 8,242 feet above sea-level. The Northern Pacific has found Cadette's Pass, about 3,000 feet lower, while, at the thirty-second parallel, near the Mexican border, its minimum altitude sinks to 5,200 feet. These

facts show a central swell or elevation in this "great divide" near the thirty-eighth parallel. Railroad profiles show a similar tendency in the plateau at the foot of the mountains. Denver, on the Kansas Pacific Railroad, is 5,300 feet above tide-water; Cheyenne, on the Union Pacific, is 6,072; Dearborn's Valley, on Stevens's preliminary survey of the Northern Pacific, is only 4,091 feet. These three points represent the heights at which the great central mountain axis springs from the general plateau, going west. Denver is 100 feet above the summit, in the thirty-second parallel, and Cheyenne is 800 feet higher; while northward to Dearborn's Valley the plateau sinks 2,000 feet. The latter point, being several degrees westward, indicates a northeastern slope of the great continental plateau following the northwestern trend of its mountain axis.

The Pacific slope of the plateau is much more abrupt. The Central Pacific Railroad is compelled to pass the western anticlinal within one hundred miles of tide-water, while the Union Pacific is enabled to distribute its grades through a distance of six hundred miles west of the Missouri River. The Sierra Nevada is the projection of the western branch of the Sierra Madre of Mexico. In California it sends off a branch westward, called the Coast Range, which, after inclosing the great Sacramento Valley, reunites with the parent range, which, in Oregon, is called the Cascade Mountains. The existence of a transverse divide, though less marked and prominent than the longitudinal "great divide," is now sufficiently indicated. Its general outline may be traced from the northwest corner of Nebraska to the northwest corner of Nevada, as an undulating water-shed between north and south bound streams. These transverse axial lines tend to divide the whole trans-Mississippi region into four great basins. Of these the northeast is drained by the Missouri and its affluents. The southeast basin is drained by the lower affluents of the Missouri and the Mississippi, and by several independent streams, of which the Rio Grande is the only one that penetrates the mountain axis. Between the Rocky Mountains and the Sierra Nevada are three separate basins, of which the northern is drained by the Columbia and the southern by the Colorado, while the Central, the great Utah basin, is cut off by encircling mountains from all drainage to the sea. The great California Valley is drained by the Sacramento and San Joaquin through the Golden Gate. The western slope of the Coast Range is watered by numerous streams of mere local character. Some general facts in regard to the capacities of these basins for irrigation are beginning to appear. The declivity of the Upper Missouri and its affluents, except near the mountains, is slight. Fort Benton is not over 3,000 feet above sea-level, while Omaha, at least one thousand miles below, by the course of the river, is nearly 1,000 feet, giving a fall of a little more than two feet per mile. In the southeastern basin, where irrigation is especially necessary, the degree of declination varies from 5 to 10 feet per mile. The Columbia basin presents nearly an equal general declination. The topography of the Colorado basin has not yet been sufficiently studied to warrant conclusions quite so hopeful. In the Utah basin facilities for irrigation are but limited and local. Those of the central valley of California are generally assumed as sufficient—a point, however, yet to be tested. The coast region of California presents a number of small basins, whose capacity for local irrigation is yet to be developed. To the northward a heavier rainfall dispenses with the necessity for irrigation.

To nearly all these regions it will be necessary to apply irrigation. From different portions come demands for information in regard to the

practical processes and general conditions of irrigation in the Old World In answer to an increasing pressure of correspondence upon the Department, the following condensation of facts from late and authoritative sources is presented.

IRRIGATION IN FRANCE.

In France, except in the south, irrigation is confined to water meadows, a system which depends for its success upon a large deposit of fertilizing sediment from waters, the temperature of which is of no special consequence. This method may be observed with greatest advantage in the Valley of the Moselle, at Épinal, where the river has a minimum discharge of 350 to 450 cubic feet per second. Though apparently very pure, its waters are highly charged with fertilizing material in solution, which it leaves as an alluvial crust upon the stones. Below Épinal it has been made to redeem and fertilize broad, gravelly beds, transforming them into beautiful green meadows, yielding crops of two to four tons per acre, besides giving to the river a permanent bank. This work was inaugurated by the two brothers Dutac, who had purchased 50 acres on the left bank of the river. They threw up a rough bowlder dam across the stream, turning about 70 cubic feet of water per second into a channel along the high ground to the left of the estate, to which a gradual slope was given, in order to facilitate the easy distribution of the water. Little branches conduct it across parallel ridges, with small openings admitting each a stream about 6 inches wide and 3 inches deep, which runs along and overflows the highest part of each ridge. This surplus, after rolling down the ridge, is caught by another little channel about 25 feet distant. The water that does not overflow is caught at the end of the channel by a catch-water drain, and is conveyed to a lower level.

The ground, after watering and without clearing it of stones, is sown with grass seed. A slight deposit of mud is left, which is increased with each flood in the river. After a year the meadow begins to yield. In three years it attains a full vigor, which it never loses. The meadows begun in 1827 have never been renewed, plowed up, or manured, yet their crops are as good as ever. The water must be let on so gently as not to sweep away the young grass. If it is suspended, even two or three hours of bright sunshine may injure the vegetation. The outlay of this system is considerable at first, but when the proper levels and slopes are secured there is but little further expense. The deposit of silt is at first very rapid, the gravel acting as a filter. By degrees, however, the bed becomes impermeably coated, and the water flows off on the drainage lines, leaving but a slight deposit. But for this the meadows would soon rise above the water's edge and necessitate the raising of the dam. For ten or fifteen days before harvest the water is cut off, in order to dry the ground and mature the growth. The first crop, of two tons per acre, is cut about the last of June; the second, about the same in quantity but inferior in quality, is cut in September. Sometimes a third crop is cut. The annual yield is about four tons per acre, worth $8 to $10 per ton. This system is becoming more prevalent. It requires an immense expenditure of water, and would be impracticable with a scant supply. The water, in passing from one level to another, loses a portion of its fertilizing elements by deposit; hence the subsequent applications are not so effective as the first.

All over the south of France irrigation is practiced in the culture of grasses, vegetables, madder, and occasionally wheat and vines. An eligible example of the system generally followed may be seen in the canals of the Durance, an affluent of the Rhine, surrounded by flat

alluvial country, well adapted to irrigation. The value of this process is seen in the fact that land entitled to irrigation rights rents at about $21 per acre, while other land brings only $16. The land varies in value from $320 to $1,200, that irrigated being about 50 per cent. more than unirrigated land, other things being equal. The irrigating season lasts from April to October. During the remainder of the season the water is used for domestic and manufacturing purposes. The Durance, rising in the Dauphine Alps, near the head-waters of the Po, has a mean slope of 16 feet per mile, and is fed both by rain and melting snow. At the head of the Marseilles Canal its discharge varies from 4,000 to 53,000 cubic feet per second. The total full discharge of all its canals does not exceed 2,000 feet per second.

The Marseilles Canal was constructed, primarily, to supply that city with water, irrigation being a subordinate idea. Its maximum discharge is 318 cubic feet per second, of which only 254 feet are used. Its waters reach only 6,420 acres of 22,200 acres of irrigable surface within its influence. Its administration is vested in the town council of Marseilles, under the supervision of the prefect of the department. The irrigators have no voice in its management, but merely purchase so much water, paying about $450 per cubic foot per second during the season. The town fixes the time for the delivery of water to each irrigator, opens and closes his *prise*, and forbids him to give away any of it, even if he has an overplus. A discharge of one cubic foot per second during the season is considered a competent allowance for 70 acres, making the cost of irrigation about $6 or $7 per acre. For the distribution of water the canal is divided into thirty cantons, in each of which are two *cantoniers*, or guards, who relieve each other every twelve hours. They are furnished with schedules regulating the quantity and time of delivery of water to each irrigator. The side-channels are constructed by the town in a very substantial manner, with vertical walls of masonry, each drawing from the canal 124 feet per second, and kept in operation by a self-acting module. This module is so contrived as to secure a uniform head of water and a consequent uniform discharge. This is effected by a circular orifice in a cistern of masonry, in which is fitted, by a water-tight collar, an iron cylinder open at each end, and moving freely up and down. Being attached to floats on the surface, it rises and falls with them, thus always securing a uniform depth under water.

The water is discharged into the canal by an elaborate system of masonry, which, however, does not embrace the latest improvements and adaptations. The general slope of the canal-bed is 1 foot in 3,030; its width, 10 feet; its side-slopes, 3 feet vertical to 4 feet horizontal; greatest depth of water, 5.58 feet; least depth (in winter) 4.26 feet; mean velocity, 2.72 feet per second. The main line is fifty-three miles long; the aggregate length of secondary channels forty-three miles. Only one-ninth of the water received from the river is lost by evaporation and seepage. It has a capacity of 4,000 horse-power available for manufacturing, of which only 770 are used. The total cost of the canal was $8,700,000; its revenues, in 1866, amounted to $178,000, of which $39,000 were derived from irrigation; $53,000 from fountains, parks, &c.; $51,000 from domestic consumption; $35,000 from mill-rent. The cost of working the canal is about $60,000, leaving less than 1½ per cent. on the capital invested.

None of the canals in the south of France belong to the government. The usual system (unlike that of the Marseilles Canal) is about as follows: Land proprietors, desiring irrigation, apply to the government for the use of so many cubic meters of water, to be delivered through a

canal of their own construction. Public engineers then examine and report on the project, and sometimes superintend its execution. The designs must, in all cases, be approved by the government, but when once finished the works are controlled by the association, except in the case of extensive repairs or enlargements, which the government engineer must supervise. Each commune or parish watered by the canal sends a deputy to the committee of management, who order its affairs under regulations prescribed by law. This system has its advantages and disadvantages. Among the latter is a certain slovenliness and lack of order everywhere observable. In the south of France, the minute subdivision of landed property is illustrated by the small portions in which irrigating waters are disposed of. Of the 1,414 subscribers to the Canal d'Isle, 1,095 required a supply for less than $2\frac{1}{2}$ acres each, and 205 more for less than 5 acres each. The whole discharge required for this canal is but 70.6 cubic feet per second. Small proprietors, working their own lands, realize greater benefit from irrigation than landlords. The former are able, with its assistance, to devote more time on their own lands to profitable labor. The latter find their tenants reluctant to advance their rents in proportion to the cost of irrigation. The canals would not exist but for these small proprietors; yet their want of capital prevents an outlay sufficient to secure the full advantages of irrigation.

IRRIGATION IN SPAIN.

The physical conditions of Spain are such as to demand extensive irrigation; yet, of her 125,000,000 acres, only 500,000 are irrigated. The government, however, has become alive to this necessity, and is trying to induce capitalists and associations to do what it is unable to do. In 1866 it enacted an elaborate "law of waters," granting concessions to canal companies, and guaranteeing protection to all investment of foreign capital. It invites the aid of local associations, but reserves the supreme direction. The Iberian Irrigation Company has constructed two canals, on condition that they shall revert to the government after ninety-nine years, the company being expected within that time to receive back their principal with a remunerating interest. To insure the turning over of the works in good order, the government may at any time interfere, and may retain the profits of the last five years until this condition is met. The water-power, however, does not revert, but continues to be the property of the company. Private branches are to be constructed by the irrigators themselves. Owners and tenants of land are not required to pay above \$7 per acre for twelve waterings per annum, each equivalent to a sheet of water $2\frac{3}{4}$ inches deep, covering the whole surface. In case of deficiency of water, it is distributed *pro rata*. The government may form syndicates to control the administration of the water, and may compel the company to erect modules.

The Henares Canal, constructed by this company, may be taken as a specimen of the latest improved method of irrigation in Spain. It issues from the Henares River, about fifty miles from Madrid, and is twenty-eight miles long. It irrigates the low lands along the river. The Henares discharges 300 to 400 cubic feet per second during nine months, but declines during three months, reaching a minimum of 140 in August. The maximum discharge of the canal is limited, by the terms of concession, to 177 cubic feet from October to June, and to 106 from July to September, inclusive. This reduction during the dry months is to protect the rights of two little canals constructed under prior concessions. The watering mains of the Henares Canal are required to be $2\frac{3}{4}$

inches deep. It has been estimated that with this depth a discharge of 1 cubic foot per second is sufficient to irrigate 8½ acres per day. The works on this canal are remarkable in both design and execution. The water is raised 20 feet by a curved weir 390 feet in length, of very elaborate construction, carried down into the solid rock beneath the bed of the river. It is supposed that the highest floods will rise 5 feet above the weir, giving a flood discharge of 20,500 feet per second. The velocity of water in the canal is limited to 2.296 feet per second, with a depth varying from 3.28 to 4.92 feet, and a width of 8.23 feet. The modules at the head of the canal are elaborate and costly, but are not self-acting. The discharge is regulated by a very neatly fitting cast-iron sluice, raised and depressed by a screw. It lets the water into a chamber of masonry, out of which it escapes over a beveled iron edge. The guard in charge keeps the water at a certain height in this chamber, opening or closing the sluice according to the rise or fall of the canal. The regularity of the discharge, then, depends upon the honesty and fidelity of the guard. At the opening of the season each irrigator applies for water for so much land and in so many waterings, using a printed form of application. He receives a set of checks, one for each watering, their counterfoil duplicates remaining with the agent. Each check prescribes the number of hours and the amount of water from a specified module. If found to correspond with the official schedule left with the guard, the water is furnished.

This canal presents several examples of admirable engineering and constructive ability. It crosses the Majano torrent through a splendid iron aqueduct 70 feet long and 6.2 feet deep, weighing 27,349 tons. Its water-way, 10.17 feet wide, holds 90 tons of water, but has strength sufficient to support 400 tons. The canal has an available water-power of 3,630 horse-power during nine months, and 1,450 during three months, rented at $50 per horse-power per annum. The cost of this canal is estimated at $600,000. It is considered the finest one in Spain, and the only one constructed upon sound engineering principles.

Among the remarkable features of the Spanish irrigating system is the "Tribunal of the waters" at Valencia, composed of the syndics of eight different canals. These eight peasant judges sit upon benches in front of the old gothic doorway of the Valencia cathedral, according to an oriental custom alluded to in the Holy Scriptures, (Prov. xxxi, 23,) and introduced into Spain by the Saracens. The mutual complaints of irrigators and officials of each canal, in turn, are heard. The syndic of the canal in question presides over the case, and then retires, leaving his colleagues to award judgment. If a culprit should remonstrate, his fine, it is most likely, would be doubled. There is no record of evidence, and no appeal. Any person may, however, elect to be tried in a civil court, but the cost of the latter proceeding is sufficient to prevent an extensive use of the privilege. If an irrigator refuse to appear, his water is shut off, and he is otherwise punished. If he be a man of rank, the guards report the case to a magistrate, who personally appears before the court with the culprit, and formally subjects him to its jurisdiction. He must submit to the award, hat in hand, and in respectful silence.

IRRIGATION IN ITALY.

Italy has had long experience of the advantages of irrigation. In the valley of the Po this process has existed from time immemorial. The irruptions of northern barbarians during the earlier ages of the Christian era caused the works erected under the old Roman Empire to fall into utter dilapidation. During the Middle Ages various attempts were made

to restore them. These efforts date back to the twelfth century in Lombardy, and to the fourteenth in Piedmont. The topography of the valley of the Po has presented difficulties in the use of the main stream for irrigation, which have been but lately overcome in the construction of the great Cavour Canal, which is the only one that traverses the primary drainage-lines of the valley. The affluents of the river, however, are more manageable. The irrigating districts, stretching back to the foot-hills of the mountains, at an inclination of 5 to 12 feet per mile, embrace about 4,000,000 acres, of which about 1,600,000 are actually irrigated, and draw from the various affluents of the Po an average discharge of 24,000 cubic feet per second. This requires the investment of capital at the rate of $1,250 per cubic foot per second, or $30,000,000. The increased rental of land produced by this improvement is estimated as high as $4,500,000 per annum. The tributaries of the Po penetrating the snow-clad ranges of the Alps insure a constant supply of water for summer irrigation. The rivers of Lombardy present a very advantageous feature in their lake-like expansions, which not only enable them more easily to control their spring floods, but also to purify their waters from injurious sediment before delivering them to the irrigating canals. The entire discharge of these rivers is estimated at 65,000 cubic feet per second.

The system of distribution in use allows to each irrigator the full discharge of the channel for a specified number of hours in each period of rotation, which varies in length from seven to sixteen days.

Prior to the unification of the present Kingdom of Italy the civil code of the Austrian Empire was in force in Lombardy, while Piedmont was regulated by the civil code of Charles Albert. In both Lombardy and Piedmont the state claims the original right of property in running waters, which cannot be utilized for irrigation without authority from the government. Certain prescriptive rights of towns, communes, and associations of proprietors to supplies which they have enjoyed for an indefinite period, have been recognized. In disposing of the waters of irrigation, the government sometimes sells its right *in toto*, or grants leases, both perpetual and temporary. During the progressive period of Italian irrigation, the great landed proprietors were either powerful feudal nobles, or municipal, religious, or charitable corporations. These proprietors generally possessed large capitals, which they applied to the purchase of the right of property in the waters of irrigation, and to a scientific application of them to the soil. Under their patronage hydraulic engineering became an honored profession, attracting superior minds in large numbers. These powerful proprietors were able to form combinations whose influence even arbitrary governments were compelled to respect. Hence their rights of property in water have never been wrested from them, and only to a limited extent have they been subjected to governmental regulation.

In Lombardy no general rule has been established for the measurement and distribution of water. The authorities, general or local, prescribe regulations, which at any time may be altered by their superiors. Each province has its own measure. For the distribution of water, the government favors the organization of the local boards. These exercise their authority through the medium of elective councils, whose powers are defined by law. They are all subject to the prefecture of the province. When objects of special importance are presented, such as the construction of new canals, the whole body of corporators is summoned to deliberate. The works are under the constant supervision of government engineers, who from time to time inspect them and report their

condition to the central authority. The expenses of construction and repair are assessed by the delegated council upon the corporators, but this assessment is not in force until approved by the prefect. This principle of association was introduced by Napoleon, during his supremacy in Italy. It has worked such beneficent results that even the Austrian government, though constitutionally averse to all popular movements, has never been able to dispense with it. The cost of irrigation in the province of Mantua is, for the first employer, about $850 per cubic foot per second per annum, where the land is nearly all cultivated; where but partially cultivated the cost is not over $750 per annum for each foot per second. The second employer, using the surplus left by the first, pays about half of these rates, and the third employer but one-fourth. Each cubic foot per second brings the authorities from $1,300 to $1,500 per annum.

In Piedmont applications for the use of irrigating water must be accompanied by three documents, which can only be prepared by a regular hydraulic engineer: First, a plan and specification of the works to be erected, illustrated with mathematical diagrams; second, longitudinal and transverse sections of the river or torrent, showing its maximum, minimum, and average discharge; third, a detailed exposition of the utility of the works, showing also that they will cause no injury to other parties, or to the stream itself. These documents must then be officially verified by the government engineer, who embraces in his report such other facts as may be necessary to the comprehension of the whole case. Three methods of distribution are common: First, waters from "unregulated outlets" are distributed according to "*use*," without reference to any prescribed quantity. The outlet is simply an opening in the bank of the canal, over which no supervision is exercised except what is necessary to prevent injury to the works. Rice-fields are exclusively supplied from unregulated outlets. The second method of distribution, from both regulated and unregulated outlets, refers only to the "*time*" for which water is granted. The third method measures the absolute "*quantity*" of water delivered. In Piedmont, as in Lombardy, association among the proprietors is encouraged by the government in the administration of the irrigation laws.

The foregoing facts pertain to the system of Italian irrigation, confined, as it was till lately, to the affluents of the Po. The utilization of the main stream by the construction of the Cavour Canal is one of the later feats of progressive engineering. This great work was constructed under contract with the Italian government, by an association of English capitalists, to whom it has proved a disastrous investment. The association was bound to raise a capital of $16,000,000—$10,680,000 for construction; $4,060,000 for payment for crown canals on the affluents of the Po; and the remainder, $1,260,000, for the extinction of private rights to irrigating waters. Upon this capital, the government guaranteed an interest of 6 per cent. per annum for fifty years. Upon the plea that the company was insolvent from the beginning; that it resorted to suspicious "financiering" for the raising of the necessary funds; and, finally, that its work was not completed according to contract, the government refused its guarantee. Though defeated in its own courts of law, the expense and delay in securing the guarantee reduced its value one-half, entailing a fatal loss upon the capitalists.

A very remarkable and unaccountable engineering blunder marked the commencement of this great enterprise. The company relied upon official estimates, stated to have been made from many years of careful measurement, whereby the minimum discharge of the Po, at the point

where the canal tapped it, was fixed at 4,167 cubic feet per second. On the completion of the canal, it was found that during July and August no reliance could be placed upon a volume greater than from 1,500 to 1,800 cubic feet per second.

The canal commences near Chivasso, on the left bank of the Po, where a temporary dam—soon to be replaced by a permanent and substantial weir—raises the water 8 feet. The entire length of the canal is fifty-three and one-third miles, sloping at least 1 foot in 4,000 throughout the whole course, and in some parts 1 in 2,000. At its head it is 131 feet wide and 6.1 feet deep. Six miles below it narrows to 60 feet, and deepens to 11.15 feet. At the thirty-ninth mile the section changes to 40 feet in width by 10.5 in depth. Its velocity varies from 4.2 to 4.9 feet per second. It crosses the Dora Baltea through an aqueduct 635 feet long, supported upon nine arches each 52.5 feet span. Several other streams are crossed either by aqueducts or siphons. The company owns five hundred and four miles of previously constructed canals, and is negotiating for the purchase of several other canals. It supplies several of these canals at different points along its line.

Near Vercelli the water of the Cavour Canal is sold to a co-operative society, known as "The General Association of Irrigation west of Sesia." This society had been previously incorporated for the administration of the crown canals derived from the Dora Baltea. Its operations illustrate the later phases of Italian irrigation. It is constituted of deputies elected by associations of irrigators in the different communes or parishes. It transacts its business mostly through three committees—the executive committee, the committee of superintendence, and the council of arbitration. The first of these is the executive or administrative power, which acts under the supervision of the second. The third is a court for the settlement of disputes and for the redress of grievances arising within the organization. In November of each year, each *consorzio*, or parish society, presents to the general authority a schedule of the number of acres it proposes to irrigate, and demands water for the coming season, in the following proportions: For rice lands, 1 cubic foot per second for each 43.75 acres; for summer meadows, 1 cubic foot per second for 100 acres; for maize, 1 cubic foot per second for each 304.3 acres. The gross amount of water is then placed at the disposal of the *consorzio*, and by its officers distributed to the several irrigators. At the end of the season the *consorzio* pays over the price of the water actually received.

The management of these local associations is confided to a board of direction, consisting of their deputy to the general association, with six to nine associates. The general association purchases from the Cavour Canal 714.4 cubic feet per second, and from the Dora Baltea Canals 674 feet per second. For the former it pays $87 per cubic foot per second, charging the irrigator $96. The water of the Dora Baltea costs only $65, and is sold at $77. The higher value of the water of the main stream results from the amount of fertilizing silt which it deposits upon the land. The society irrigates about 138,000 acres of land. All surplus water not absorbed by the land reverts to the association and is re-collected in their drains.

IRRIGATION IN INDIA.

The British government, upon assuming the sovereignty of India, found irrigation canals already constructed. The English authorities, attempting to enlarge the operation of the Indian irrigation system, especially by ingrafting upon it the principles and processes that have been so successful in the south of Europe, found a very serious obstacle in the

habits and ideas of the Hindoos. There is no disposition of self-help among them. Their industry is controlled and cramped by their routine ideas and habits. Hence it has been found impractiable to introduce those elements of local administration which have been found so effective in Southern Europe. The Hindoo expects the government to manage all the details, as well as the general matters of a system of irrigation. This imposes upon the central authority a burden of care and labor which cannot fail to greatly retard its effective action.

IRRIGATION IN OUR TERRITORIES.

The application of water to the arid areas west of the Mississippi dates back to the earliest Spanish colonization. In California, Arizona, Nevada, New Mexico, Colorado, and Texas are the remains of old works of irrigation, rude copies of those introduced into Spain by the Saracens. In New Mexico it has been observed that the method of terrace or bench distribution has resulted in the impoverishment of the higher levels by the washing of the fertilizing principles of the soil. One of the preliminary points of a more effective irrigation will be the avoidance of errors of this character. As a specimen of the manner in which our intelligent pioneer agriculturists deal with this difficulty, may be cited the statement of Governor Hunt, of Colorado, published in the last annual report of this Department. In California the mission fathers sometimes elevated water for irrigation by means of a wheel furnished with buckets, and moved by force of the current; sometimes the uplifting force was supplied by animal power. The water was raised into large tanks and distributed over the neighboring plains and slopes. This method involved a great expenditure of labor for insignificant results. Subsequently these works were enlarged by the construction of canals reaching to the higher elevations of mountain streams, and securing a constant supply of water. Then, in 1833, the temporal authority of the missionaries was subverted, the Indians refused to labor upon the works of irrigation, and, consequently, these fell into great neglect. Many of these water-works were furnished with cisterns, built very much like those of Palestine and Syria, mentioned in the Scriptures.

The methods of constructing these Spanish works have passed away with the authority which devised them, and the abject social condition of the race by whose labor they were executed. In New Mexico the usual method of irrigation is by means of a mother ditch—*acequia madre*—constructed at public expense, from which each farmer runs a channel to supply his own farm. The supply of water is regulated by public authority. The necessity for irrigation appears to be less pressing as the country becomes more densely settled. The rivers are growing in volume, while intermittent streams are becoming constant. Many *acequias* are falling into dilapidation for lack of use.

This idea of local organization for the construction of works of irrigation is destined to an enormous extension by the American and European emigrants now crowding to all the eligible positions of our public domain. In the last annual report of this Department extracts from local correspondence were given, showing some of the methods of organization for the construction of irrigating works, with some results already obtained. In the Greeley colony of Colorado canals are constructed by the owners of farms by an assessment ranging from $1 to $3 per acre. The right to use the water is then attached to the land in perpetuity with annual assessments for repairs and superintendence. In favorable localities in New Mexico and Colorado the farmers of a neighborhood combine in similar arrangements. In other parts of the country com-

panies are incorporated by government, and furnish water at a stipulated rate per annum. Sometimes the charge is regulated by the number of cubic inches delivered, and sometimes by the number of acres watered to an average depth. The Table Mountain Water Company, of Jefferson County, Colorado, sell water at $1.50 per cubic inch, to be taken out of the ditch with spouts or boxes at right angles to the axis of the current, no spout allowed of a section greater than thirty square inches. The boxes are 3 inches by 10, and set edgewise in such manner that there will be a pressure of five inches upon the center. Increase of superincumbent pressure is found to increase loss by leakage.

The subject of irrigation has, till recently, received comparatively little attention in California. Indeed, elaborate efforts have been made to demonstrate that its necessity is more fanciful than real; but these efforts diminish as the wants of an increasing population become more pressing. Irrigation is now considered a prime necessity by intelligent agriculturists in different parts of the State. In 1862 the State legislature passed an act giving to irrigation and mining canal companies the privileges previously exercised by railroad corporations, enabling them to condemn private lands for this public use.

A single farmer near Sacramento finds it profitable to irrigate his farm in a very expensive manner, raising, by steam-power, water from wells to tanks 14 feet above the ground, whence it is distributed through 12,000 feet of subterranean pipes. The coal by which this water is raised costs from $15 to $20 per ton, yet the high prices of farm produce in the neighborhood render this operation profitable.

Associated irrigation enterprises are already in the field. Of these, one of the most important is the California Canal and Irrigation Company, which proposes to construct a canal trunk-line from the south end of Kern Lake, northwardly, a distance of five hundred miles, along the Sierra Nevada to Red Bluff, in Sacramento Valley. This canal is calculated for navigation as well as irrigation, and will derive its supply from an area of over twenty thousand square miles of the western water-shed of the sierra. Another trunk-line is proposed on the western side of this great valley, from Kern, Buena Vista, and Tulare lakes, running northwardly along the foot-hills of the Coast Range one hundred and sixty three miles, and thence to Stony Creek, two hundred miles farther, making a grand total of nearly nine hundred miles of canal, with an estimated capacity of irrigating nearly 10,000,000 acres of land.

The Lake Tahoe and San Francisco Water-Works Company proposes to draw from Lake Tahoe, through Truckee River, and a canal to San Francisco, over 800,000,000 gallons of water per day for the supply of this city and towns along the line of the canal, and for purposes of irrigation. The California Irrigation Company contemplates the construction of a canal from the west bank of Sacramento River, Suisun Bay, with feeders for gathering the waters of smaller streams. The object of this canal is the irrigation of the land between the Sacramento and the Coast Range. The Lake Tahoe and American River-Water Company proposes to draw water from Truckee River and Lake Tahoe, through Squaw Valley, and by tunnels through the mountains to American River, in Placer County, to be stored in a great reservoir for domestic, mining, and irrigation purposes. The Tuolumne Irrigation Canal Company proposes to construct two irrigation canals from Tuolumna to San Joaquin River. This enterprise, it is said, will render available to cultivation 500,000 acres of rich valley land between Merced and Stanislaus Rivers. Other enterprises have been inaugurated for the supply of water to cities, towns, and mining camps, several of which also include water for irrigation.

THE CENTENNIAL OF AMERICAN INDEPENDENCE—ITS RELATIONS TO AGRICULTURE.

An act of Congress, approved March 3, 1871, provides, as stated in its title, "for celebrating the one hundredth anniversary of American Independence, by holding an international exhibition of arts, manufactures, and products of the soil and mine, in the city of Philadelphia and State of Pennsylvania, in the year eighteen hundred and seventy-six." The credit of first suggesting this form of celebrating the centennial of American Independence has various claimants. The American Institute, of New York, first memorialized Congress upon the subject, but was speedily followed by a joint memorial of the Franklin Institute of Philadelphia, the councils of that city, and the legislature of Pennsylvania. Mr. Morrell, of Pennsylvania, chairman of the House Committee on Manufactures, which had charge of the bill, in a speech made upon it, alleged that the subject had been agitated in Philadelphia as early as 1868, and that a leading journal of Cincinnati, in 1869, had suggested editorially the holding of a centennial celebration and industrial exposition in the city of Philadelphia. It is such an idea as would naturally suggest itself to thoughtful minds, and numerous persons may rightfully claim to have originated it. The proposition was received with favor by Congress, and an animated struggle between New York and Philadelphia for the honor of holding the exposition resulted in favor of the latter city,

The bill as passed provides that an exhibition of American and foreign arts, products, and manufactures shall be held, under the auspices of the Government of the United States, in the city of Philadelphia, in the year 1876. A commission, consisting of one delegate from each State and Territory, is constituted by appointment of the President, upon the nomination of the governors of States and Territories, whose duty it is to prepare and superintend a plan for holding the exhibition, and, in conjunction with the authorities of the city of Philadelphia, to fix upon a suitable site within the limits of the city where the exhibition shall be held. The act provides for alternate commissioners to be appointed in the same manner as their principals, that the commission shall hold its meetings in Philadelphia, and that a majority shall control its business.

It is further the duty of the commission to report to Congress a suitable date and appropriate ceremonies for opening the exhibition, plans of the buildings, plans for the reception and classification of articles for exhibition, custom-house regulations for the introduction of foreign articles, and other matters which they may deem important. When the President is informed by the governor of the State of Pennsylvania that provision has been made for the erection of suitable buildings to be in the exclusive control of the national commission, it is made his duty to issue a proclamation fixing the time and place for holding the exhibition, and to furnish copies of this proclamation and the regulations adopted by the commission to the representatives of foreign countries.

It is provided that the commissioners shall receive no compensation, and that the United States shall not be liable for any expenses.

This bill does little more than give such national recognition to the enterprise as will accredit it with foreign countries, leaving the labor, expense, and responsibility to be borne by private citizens, with such aid as can be given by the city of Philadelphia and the several States. Congress seems to have exercised extreme caution in the premises, and will probably come to the aid of the national commissioners when the

project has so far advanced as to demonstrate the utility of further legislation.

Under the provisions of the act commissioners have been appointed from the States and Territories as follows:

Alabama: William M. Byrd, commissioner, Selma; James L. Cooper, alternate, Huntsville. *Arizona Territory:* Richard C. McCormick, commissioner, Tucson, (Washington, D. C.;) John Wasson, alternate, Tucson. *Arkansas:* F. W. Gantt, commissioner; Alex. McDonald, alternate, Little Rock. *California:* John Dunbar Creigh, commissioner, No. 714 Shotwell street, San Francisco; John Middleton, alternate, 509 Montgomery street, San Francisco. *Colorado Territory:* J. Marshall Paul, commissioner, Fair Play; N. C. Meeker, alternate, Greeley. *Connecticut:* Joseph R. Hawley, commissioner, Hartford; Wm. P. Blake, alternate, New Haven. *Dakota Territory:* George A. Batchelder, commissioner, Yankton, Dakota, and National Hotel, Washington, D. C.; Solomon L. Spink, alternate, Yankton. *Delaware:* William T. Read, commissioner, New Castle; John H. Rodney, alternate, New Castle. *District of Columbia:* James E. Dexter, commissioner, 322 Four-and-a-half street, Washington; Lawrence A. Gobright, alternate, Washington. *Florida:* John S. Adams, commissioner, Jacksonville; J. T. Bernard, alternate, Tallahassee. *Georgia:* Thomas Hardeman, jr., commissioner, Macon; Lewis Waln Smith, alternate, 707 Walnut street, Philadelphia, Pennsylvania. *Idaho Territory:* Thomas Donaldson, commissioner, Boise City; James S. Reynolds, alternate, Boise City. *Indiana.*—John L. Campbell, commissioner, Wabash College, Crawfordsville; David M. Boyd, jr., alternate, Pennsylvania Railroad office, Philadelphia. *Iowa:* Robert Lowry, commissioner, Davenport; Coker F. Clarkson, alternate, Grundy County. *Illinois:* Frederick L. Matthews, commissioner, Carlinville; Lawrence Weldon, alternate, Bloomington. *Kansas:* John A. Martin, commissioner, Atchison; George A. Crawford, alternate, Fort Scott. *Kentucky:* Robert Mallory, commissioner; Smith M. Hobb, alternate. *Louisiana:* John Lynch, commissioner, lock box 980, New Orleans; Thomas C. Anderson, alternate, Opelousas. *Maine:* Joshua Nye, commissioner, Augusta; Charles P. Kimball, alternate, Portland. *Maryland:* Wm. Prescott Smith, commissioner, Baltimore; John W. Davis, alternate, Annapolis. *Massachusetts:* J. Wiley Edmands, commissioner, Newton; Wm. B. Spooner, alternate, 163 Congress street, Boston. *Michigan:* James Birney, commissioner, Bay City; Claudius B. Grant, alternate, Ann Arbor. *Minnesota:* J. Fletcher Williams, commissioner, Saint Paul; W. W. Folwell, alternate, Saint Anthony. *Mississippi:* O. C. French, commissioner, Jackson. *Montana Territory:* Wm. H. Claggett, commissioner; Henry L. Warren, alternate. *Nebraska:* Henry S. Moody, commissioner, Omaha; R. W. Furnas, alternate, Brownsville. *Nevada:* William Wirt McCoy, commissioner, Eureka, Lander County. *New Hampshire:* Ezekiel A. Straw, commissioner, Manchester; Asa P. Cate, alternate, Northfield. *New Jersey:* Orestes Cleveland, commissioner, Jersey City; John G. Stevens, alternate, Trenton. *New Mexico Territory:* Eldridge W. Little, commissioner, Santa Fé. *New York:* John V. L. Pruyn, commissioner, Albany; Charles H. Marshall, alternate, 38 Burling Slip, New York City. *North Carolina:* Alfred Dockery, commissioner, Rockingham, Richmond County; Jonathan W. Albertson, alternate, Hartford, Perquimans County. *Ohio:* Alfred T. Goshorn, commissioner, Cincinnati; Wilson W. Griffith, alternate, Toledo. *Oregon:* James W. Virtue, commissioner, Baker City; Andrew J. Dufur, alternate, Portland. *Pennsylvania:* Daniel J. Morrell, commissioner, Johnstown; Asa Packer, alternate, Bethlehem. *Rhode Island:* George H. Corliss, commissioner, Providence; Samuel Powell, alternate, Newport. *South Carolina:* James L. Orr, commissioner, Anderson; Archibald Cameron, alternate, Charleston. *Tennessee:* Thomas H. Coldwell, commissioner, Shelbyville, Bedford County; William F. Prosser, alternate, Nashville. *Texas:* William Henry Parsons, commissioner, Houston, Texas, or 29 Broadway, New York. *Utah Territory:* John H. Wickizer, commissioner, Salt Lake City; Oscar G. Sawyer, alternate, Salt Lake City. *Vermont:* John N. Baxter, commissioner, Rutland; Henry Chase, alternate, Lyndon. *Virginia:* Walter W. Wood, commissioner, Halifax Court-House. *Washington Territory:* Elwood Evans, commissioner, Olympia; Alex. S. Abernathy, alternate, Cowlitz County. *West Virginia:* Alex. R. Boteler, commissioner, Shepherdstown; Andrew J. Sweeney, alternate, Wheeling. *Wisconsin:* David Atwood, commissioner, Madison; Edward D. Holton, alternate, Milwaukee. *Wyoming Territory:* H. Latham, commissioner, Laramie City; Robert H. Lamborn, alternate, 125 South Fifth street, Philadelphia.

A majority of the commission assembled in Philadelphia on the 4th day of March, 1872, where they were welcomed by the authorities of the city, and, during a protracted session, were entertained as its guests. A permanent organization was effected, as follows:

OFFICERS.

President.—Joseph R. Hawley, Connecticut.

Vice-presidents.—Orestes Cleveland, New Jersey; Alfred T. Goshorn, Ohio; William M. Byrd, Alabama; John Dunbar Creigh, California; Robert Lowry, Iowa.

Executive commissioner.—William P. Blake, Connecticut.

Temporary secretary.—Lewis Waln Smith, Philadelphia, Pennsylvania, alternate for Georgia.

Counselor and solicitor for the commission.—John L. Shoemaker, Philadelphia.

STANDING COMMITTEES.

Executive committee.— Daniel J. Morrell, Pennsylvania; John V. L. Pruyn, New York; George H. Corliss, Rhode Island; Wm. Prescott Smith, Maryland; John Lynch, Louisiana; John G. Stevens, New Jersey; Walter W. Wood, Virginia.

Committee on plans and architecture.—Alfred T. Goshorn, Ohio; William Henry Parsons, Texas; John N. Baxter, Vermont; Ezekiel A. Straw, New Hampshire; David Atwood, Wisconsin; Orestes Cleveland, New Jersey; George A. Batchelder, Dakota.

Committee on tariffs and transportation.—O. C. French, Mississippi; David M. Boyd, jr., Indiana; Charles H. Marshall, New York; Joshua Nye, Maine; Andrew J. Sweeney, West Virginia; Wm. F. Prosser, Tennessee; John H. Wickizer, Utah.

Committee on finance.—J. Wiley Edmands, Massachusetts; Asa Packer, Pennsylvania; Samuel Powell, Rhode Island; James Birney, Michigan; J. Marshall Paul, Colorado.

Committee on foreign affairs.—John L. Campbell, Indiana; John G. Stevens, New Jersey; Robert H. Lamborn, Wyoming; John V. L. Pruyn, New York; Lewis Waln Smith, Georgia.

Committee on classification and opening services.—James L. Orr, South Carolina; Richard C. McCormick, Arizona; Henry S. Moody, Nebraska; Samuel Powell, Rhode Island; Wilson W. Griffith, Ohio.

Committee on legislation.—David Atwood, Wisconsin; Orestes Cleveland, New Jersey; William M. Byrd, Alabama; William F. Prosser, Tennessee; James E. Dexter, District of Columbia; Solomon L. Spink, Dakota; William H. Clagget, Montana.

The city of Philadelphia has made a liberal appropriation for preliminary expenses. The essential requisites of a proper site for the proposed exhibition seem to be found in Fairmount Park, which has been selected by the commission. Within its area of 3,000 acres, a liberal, open, elevated space, traversed by railroads and accessible by street cars, can be set apart for the buildings which may be needed. The fine scenery of the park, which embraces within its limits the romantic Schuylkill and Wissahickon, will add much to the pleasure of visitors. The city has an excellent reputation for healthfulness, good order, and cleanliness; in all respects it worthily represents American ideas and progress, and as the principal manufacturing city in the United States it possesses peculiar advantages for displaying the processes and products of that form of industry. The international character of the exhibition apparently rendered it necessary that a large sea-board city should be the place, and no serious objection to Philadelphia was made by the representatives of the States whose industry is mainly agricultural. The disadvantages to agricultural exhibitors and visitors incident to the selection of Philadelphia seem to be inevitable, and the representatives of that interest must begin at once to study how to overcome them, a labor which may have compensating benefits. Agriculture must play a more important part than it has heretofore either in national or international expositions of industry.

Those who are charged with official responsibilities connected with the exhibition will anxiously study the history of former enterprises of like nature, and there will be a general desire for information concerning their most prominent characteristics and important results.

Competitive exhibitions of the products of industry mark a new era in the history of mankind. They perform in modern society, which is organized for peace, the functions of military triumphs, trophies, and tournaments of the earlier ages, in which society was organized for war.

Originating in France, in the latter part of the last century, they were contemporaneous with the French revolution, and may be said to have been an outgrowth of it. That country was then farthest advanced both in the useful and ornamental arts, and the first purely indus-

trial expositions were of the processes and products of manufactures. Before that time fairs were periodically held in many cities of Europe, but these were concourses of merchants, met for trade, not exhibitions for the encouragement of industry.

After returning from his Italian campaign, Napoleon projected an exposition of French national industry, and erected a structure in the Champs de Mars, the scene of later and greater exhibitions, where it was held. This was the first exposition held under national auspices, and Napoleon deserves not only the honor of originating it, but also of establishing the jury system, and defining methods of classification and administration which have been of continued utility. His success was assured, for the French add to the instinctive sympathies of race the ideas and feelings which belong to members of an old and powerful nationality. The world has repeatedly seen what may be effected by appealing to Frenchmen in the name of France. Industrial expositions demonstrated that they were first in arts as in arms, and they have constantly striven to maintain their supremacy. Under every ruler the introduction of new industries, and the encouragement of old, take rank among the principal concerns of the French government.

The national industrial expositions held at Paris in 1802, 1806, 1819, 1823, 1827, 1834, 1839, 1844, and 1849 were of constantly increasing proportions, testifying not only a rapid progress in the arts and industries, but also a growing sense of their importance to society and of the duty of the state to foster and encourage them. They had also an influence upon other countries, which presently manifested itself in a new phase of industrial progress.

The application of steam power to the production and transportation of commodities, beginning with the era of industrial expositions, has caused the immense development of inventions and industries characterizing the present century, and from it have resulted the international comities and competitions which have found their highest and most intense expression in international industrial fairs and expositions.

The English people, though inventive and progressive, are slow to accept ideas from abroad; they are wedded to old habits, and English workmen have been and are disposed to adhere to their own methods and processes. England quietly submitted to the superiority of the French in all fabrics of art, elegance, and luxury, and it was after French industry, under the stimulus of national encouragement and special education, began to combine taste and cheapness in the production of articles of comfort and use, thus developing a dangerous trade rivalry with England, that the English people discovered that the processes and results of industry were matters not only of individual but also of national concern. They became convinced of the importance of systematic technical education, and recognized the superiority attained in many industries abroad as the direct result of superior educational facilities.

Prior to the international exhibition or world's fair of 1851, English societies for the encouragement of the arts made collections of the materials and products of manufactures, and great fairs, which were commercial or financial in their objects, were held, and local exhibitions of domestic fabrics were made at Manchester, Birmingham, and Dublin, which were extensive and interesting; but were without national recognition, and did not claim to be representations of national industry.

On the continent of Europe the example of the French national expositions had been imitated in Spain, the Netherlands, Germany, and Russia; but these movements made no deep impression in history or literature, and their character and results are difficult to trace. In 1845

an exhibition of industrial products was given at Munich, under the patronage of the King of Bavaria, an example imitated by Belgium in 1847, in the "*exposition de l'industrie*," held at Brussels, which revealed the inferiority of Belgian products, as compared with French; a disadvantage which the former country, in accordance with the usual results of competitive exhibitions, has since striven very successfully to overcome.

The following record of French industrial expositions indicates the progress of that nation's industries:

Date.	Place.	Number of exhibitors.	Number of prizes.
1798	Champs de Mars	110	23
1801	Louvre	220	80
1802	Louvre	540	254
1806	Esplanade des Invalides	1,422	610
1819	Louvre	1,662	869
1823	Louvre	1,642	1,091
1827	Louvre	1,695	1,254
1834	Place de la Concorde	2,447	1,785
1839	Champs Élysées	3,281	2,305
1844	Champs Élysées	3,960	3,253
1849	Champs Élysées	5,494	4,000

France having thus thoroughly naturalized industrial expositions, was prepared to invite the competition of the world, but in this was anticipated by England, which had the honor of originating the first international exhibition, and eclipsing all former achievements in the novel and brilliant world's fair held at London in 1851. While the government assumed no responsibility for this enterprise, it had such informal recognition as resulted from the fact that the prince consort was the first to suggest it to the Society of Arts, on June 15, 1849, and was its president and patron; and the appointment of a board of royal commissioners, to participate in its management, impressed upon it the stamp of nationality. The fairy structure, known throughout the world as the Crystal Palace, erected for the uses of the exhibition, was a revelation in architecture, and was itself worthy of the highest prize offered to the industrial achievements of mankind. The fair was a pecuniary success. It was undertaken upon voluntary subscriptions, which stood as a security for capitalists who assumed responsibilities to the amount of $1,000,000, upon which the Bank of England advanced all the money required. The fair opened on May 1, 1851, and continued until October 11, being visited by 6,170,000 persons. The whole number of exhibitors was 17,900, among whom there were distributed 3,088 medals, being at the rate of a prize to every 5½ exhibitors. The commissioners received about two and a half million dollars, and, after paying all expenses, had a surplus of over a million dollars.

The world's fair of 1851 was such an exhibition of the results of industry as had never before been seen; it had the most beneficial and far-reaching consequences, and was the beginning of a series of similar enterprises, to which we will briefly allude, ending in the universal exposition of 1867, which, because of its various excellencies and the part taken in it by the United States, is deserving of attentive study.

In 1853 an international exhibition was held in New York, under the

management of a joint-stock company chartered by the legislature of that State. The President of the United States and several Federal and State authorities assisted at the opening ceremonies. It was held in a crystal palace, constructed of the same materials as the London building, upon which it is said to have presented some important improvements, though but one-third of the size. Though not a financial success, it served to demonstrate the progress of the manufactures of the United States, and gave important encouragement to domestic industry.

In 1855 France adopted the principle of international competition, and held an exposition which attracted 23,954 exhibitors, and, as contrasted with the world's fair of 1851, showed marked industrial progress. Very creditable international expositions were made at Haarlem and Brussels in 1861, and in 1862 England gave her second international exhibition in a building erected for the purpose in South Kensington, a suburb of London, which attracted 87,000 more visitors than the world's fair of 1851. There were 28,653 exhibitors. The government of Austria proposes to hold an international exposition of the products of agriculture, art, and industry at Vienna in the spring of 1873, in which the United States have been invited to co-operate. The subject has been a matter of correspondence between the Austrian minister, resident at Washington, and our State Department, and is now before Congress.

Owing to the lack of governmental recognition or encouragement, the United States had not a proper national representation in the international exhibitions prior to the Paris universal exposition of 1867; but the part which, notwithstanding great disadvantages, our country then performed was in every way creditable to us as a nation, and entitles us to expect favorable responses to the invitation which our centennial celebration will extend to foreign countries.

In the history of France there has not been a prouder moment than the opening of this last and greatest exhibition of the varied and beneficent gifts of nature and the triumphs of human toil and genius. In all the general features of arrangement and management it attained to almost ideal perfection, and while our national commissioners may plan something different, it will be difficult to accomplish anything better.

The universal exposition took its origin from imperial decrees of 1865 and later dates, which fixed the time of its opening on April 1, 1867, and placed it under the direction of an imperial commission of sixty members, of which the Prince Napoleon was named president. The place selected for the exhibition was the Champs de Mars, where, in 1798, under the rule of the directory, the first national display of the products of industry was made. It is a parade ground in rectangular form, having an area of 119 acres. To this was added the island of Billancourt, containing 52 acres, in which the display of agricultural implements was made.

The commissioners divided the objects to be exhibited into ten principal groups, under which were arranged ninety-five classes, constituting a scientific, exhaustive, and symmetrical catalogue and classification of the things which minister to the wants of civilized men, employ their labors, and adorn their lives.

In the middle of the grounds, adorned by fountains, an ornamental garden was laid out in the form of a rectangle with rounded ends, traversed longitudinally by a great avenue, and cut by three cross avenues, all of which extended to the extremity of the grounds. Around this garden was constructed a gallery having the same form, which was devoted to—

GROUP I.—Consisting of works of art, classified from 1 to 5, the inner portion of this gallery next the garden being set apart to the display of such antiquities from the relics of the flint or stone age, downward to the eighteenth century, as would constitute a history of human labor.

Outward from this successive galleries were erected, each accommodating a group of objects arranged in the following order:

GROUP II.—Apparatus and applications of the liberal arts, classes 6 to 13.

GROUP III.—Furniture and other objects for the use of dwellings, classes 14 to 26.

GROUP IV.—Clothing, including fabrics, and other objects worn upon the person, classes 27 to 39.

GROUP V.—Products, raw and manufactured, of mining industry, forestry, &c., classes 40 to 46.

GROUP VI.—Apparatus and processes used in the common arts, classes 47 to 66.

GROUP VII.—Food, fresh or preserved, in various states of preparation, classes 67 to 73.

Here terminated the principal building upon an exterior avenue, there being places elsewhere for the display of the other groups, viz:

GROUP VIII.—Live stock and specimens of agricultural buildings, classes 74 to 82.

GROUP IX.—Live produce and specimens of horticultural works, classes 83 to 88.

GROUP X.—Articles exhibited with the special object of improving the physical and moral condition of the people, classes 89 to 95.

This building constituted a series of concentric galleries, ellipsoidal in form and one story in height, the two inner galleries being built of stone and the outer ones of iron. These galleries were divided at the sides of the building into rectangular spaces by the avenues; and other streets radiating from the central space, and extending to the periphery, made divisions which were small in the center and widened in progressing outward, like the spaces between the spokes of a wheel.

The products of each country followed the direction of the streets and avenues, so that in passing along these all the various articles belonging to the first seven groups, exhibited by one nation, were successively seen, while in following the galleries all the objects in one group exhibited by every nation were presented to the spectator. There was thus given the opportunity for studying the development of any art or industry of different nations, or the development of all the arts and industries as displayed in the products of a single country, the comparison of one country with another being conveniently and easily made. The building covered 39 acres. Its greatest length was 1,125 yards, its greatest width about 515 yards, and its circumference nearly a mile. Thirty-five countries claimed and occupied a place within it. Its streets and avenues which latter we have likened to the spokes of a wheel, divided it into sixteen spaces, of different form, but nearly equal area, of which France absorbed seven, Great Britain occupied two and a half, Belgium one, Prussia one, and Austria little more than one-half; the United States filled about one-third of a division, or one forty-eighth part of the whole. There were 50,226 exhibitors, 703 of whom were citizens of the United States. Mr. Beckwith, commissioner general on the part of the United States, published with his report a table showing the very high position conceded to American products by the award of prizes to exhibitors. In comparing the general percentages of the various prizes to the whole number of exhibitors and the percentages which the awards to each

country bore to the number of its exhibitors, it appears that the United States had the highest general average, except France; stood next to France in the percentage of gold medals, silver medals, and honorable mentions; and bore away a larger percentage of grand prizes than any other country, being three to one better than France, and distancing all other competitors.

The history of the American portion of the exposition is a record of great difficulties, overcome by the disinterested zeal and untiring labors of a few patriotic citizens.

The French minister resident at Washington, by a letter, dated March 27, 1865, invited the United States to participate in the exposition, and suggested the appointment of an agent to represent our Government at Paris. The matter was the subject of official correspondence between Mr. Bigelow, our minister to France, Mr. N. M. Beckwith, a highly accomplished and patriotic American gentleman then residing in Paris, and Mr. Seward, our Secretary of State. After the promulgation of the plans of the imperial commission, it appeared that the selection of certain officers was indispensable to participation in the exposition by the United States, and Mr. Bigelow, minister to France, was constituted special agent of the United States, Mr. N. M. Beckwith, commissioner general of the United States for the exposition, M. J. F. Loubat, honorary commissioner, and J. C. Derby, general agent, resident at New York.

The necessity of acting before Congress could meet to validate these appointments, or make any appropriation for expenses, placed the agents of the United States at an extreme disadvantage, and the mass of correspondence between our representatives and the imperial government is made up of urgent demands on the one side for more time for preparation, and as urgent, and, at last, peremptory demands for more speed upon the other.

The apparent indifference and negligence on the part of our national and State legislatures and the people at large was a result of the disorganization of business and industries consequent upon the civil war in which the country had been engaged, and these difficulties were at last partially overcome by the untiring labors of Mr. Beckwith, and the gentlemen officially associated with him. As it was, the opening of the exhibition found the department allotted to the United States a scene of confusion, resulting from the late delivery of goods, and the absence of exhibitors, which prevented such display to the juries as time and taste might have afforded.

Congressional action with reference to the Paris exposition was as follows: By joint resolution, approved January 15, 1866, the action of the Secretary of State in appointing agents to represent the Government, &c., was approved, and certain powers were given to him and to the general agent at New York City. By joint resolution, approved July 5, 1866, the sum of one hundred and fifty-six thousand four hundred and three dollars was appropriated to the specified purposes of providing furniture and fixtures in that part of the buildings assigned to the use of the United States, for accommodations in the park, compensation of principal agent, office-rent and clerk-hire in New York, transportation and reception of goods, attendance at the exhibition, linguists, clerk-hire, &c., at Paris, and the expense of ten professional and scientific commissioners representing the United States, who were appointed by the President. The President was authorized to appoint twenty additional commissioners to serve without salary or payment of expenses.

Joint resolution, approved January 11, 1867, authorized the Commis-

sioner of Agriculture to collect and forward for exhibition suitable specimens of the cereal products of the United States.

Joint resolution, approved March 12, 1867, constituted the United States commission at the exhibition, consisting of the commissioner general, the thirty commissioners above authorized, and twenty honorary commissioners to be designated by the commission and to serve without compensation. An appropriation of $50,000 was made to meet additional expenses. This made the total appropriations for expenses amount to the sum of $206,403, being nearly $100,000 less than the estimate of the commissioner general. The expenses of the Paris agency amounted to $90,918.33, and the New York agency spent $54,473.33.

The American side of the exposition revealed unexpected excellencies and equally unexpected defects. The inventors of the ocean cable, printing telegraph, and reaping machine, received grand prizes, and a Massachusetts woolen mill was admitted to the front rank of institutions which have developed harmony among co-operators, and promoted in an eminent degree the material, moral, and intellectual well-being of workingmen. Only ten prizes in this new order of recompense were distributed by the jury.

The eighteen gold medals carried away by American exhibitors were awarded to musical instruments, steam-engines, agricultural, sewing, and other machines and machine-tools, fire-arms, artificial teeth, gold and silver ores, and specimens of short-staple cotton. The American pianos were, as compared with all others, of unapproachable excellence, and the celebrated musicians of Europe exhausted the language of eulogy in their praise. The marked superiority in guns, cannon, and implements of warfare of the United States might be pardoned by the philanthropist, because of a like superiority in ambulance service and organizations, medical and sanitary, for the relief of sick and wounded soldiers.

After the close of the exposition the reports of the United States commissioners and of the scientific experts employed by them were published by order of Congress, in six octavo volumes, and have been widely distributed.

The exhibition made by the United States was not, to the ordinary observer, an adequate representation of American ideas, arts, or inventions, but from it the thoughtful student could infer excellencies not exhibited. In the mowing machine he would see a result of high wages in a form of agriculture in which land is plentiful and labor scarce, and would rightly suppose the existence of numberless smaller inventions and appliances, less costly, but not less important, springing from the same causes, and illustrating the intelligence of the American farmer and the mutually helpful relations of the American agriculturist and artisan. The sewing machine would speak not less eloquently of the sphere of woman's labor, and the employments and comforts of the American home which has innumerable and nameless conveniences unknown to other countries except in so far as Yankee notions may have reached them as an article of commerce.

Of the products of agriculture, notwithstanding the efforts of the Department of Agriculture, nothing like an adequate display was made, and it is noticeable that raw cotton was the only article upon exhibition deemed worthy of a gold medal, the peculiar excellency of which is the result of natural advantages possessed by the United States. In the department of cereals, where our country should have excelled all nations, there was a comparatively meager display, and although some

specimens of wheat from California, Wisconsin, Illinois, Iowa, and Minnesota were excellent in quality, and the corn of Illinois surpassed in the size of its stalks and the profusion of the grain anything in the exhibition, the display, as a whole, did not attract attention or compare favorably with that made by Russia, Egypt, Austria, Prussia, England, France, or even Australia. The variety and excellence of the grain crops of these and other countries represented in the exposition were strongly manifested, and awakened in the minds of the American commissioners serious concern for the agricultural interests of the United States.

One of the lessons taught by the exposition was that our export trade in wheat must encounter the dangerous rivalry of Russia, and can only be maintained for a time by such attention to the introduction of superior seeds and such care in all the processes of preparation for market as will insure superiority of product. This is the conclusion announced by those whose duty it was to inform themselves thoroughly upon the subject, and they apprehend that improved agriculture, the introduction of machinery, and additional facilities of transportation will eventually enable Russia to exclude the United States from any profitable European market for grain. It is, therefore, a matter of paramount concern to the agriculturists of the country to provide against such a contingency by improvements in the art of agriculture and by seeking to create or control other markets, and more especially by substituting for grain the culture of other and more profitable products.

The exhausting effects of the continued exportation of grain is shown in the constantly declining product per acre of the States depending upon this trade, and a continued removal westward of the zone of largest productiveness to new soils of natural fertility. It is possibly unfortunate that this process was ever apparently profitable, and its cessation in the near future may not prove to be a calamity. Increase of population and the development of mining and manufacturing industry tend to enable the farmer to withdraw from the foreign market, and to cultivate the perishable crops, which are beneficial to the land and are consumed near to the place of production. Under this process fertility is gradually restored to the soil and the profits of agriculture are permanently increased by the steady demand of a home market.

The exposition, which disclosed a danger to our agriculture that since then has been so plainly manifested as to draw words of warning from the President in his annual message,* gave hints which may help us to a remedy. It opened to our view a field, until lately untried by the American agriculturist, in which other countries have met with most distinguished success, as may be illustrated by reference to the history of a single product. Specimens of beet sugar, the machines for its manufacture, and the statistics of its production, had a prominent place in the exposition, and in one of the most interesting and valuable reports of the American commissioners.

Looking at the results which have been accomplished in other countries, the importance of this industry to the United States can hardly be estimated. Its introduction into France, Germany, and Austria has given these countries the power of self-supply, with a rapidly increasing

* The extension of railroads in Europe and the East is bringing into competition with our agricultural products like products of other countries. Self-interest, if not self-preservation, therefore, dictates caution against disturbing any industrial interest of the country. It teaches us, also, the necessity of looking to other markets for the sale of our surplus.—*Annual message*, 1869.

consumption, and the latter country is largely an exporter of beet sugar.

The declared value of the various forms of foreign sugars which, in the year 1870, entered into consumption in the United States was nearly $72,000,000, being little less than the value of the total domestic export during that year of wheat, flour, corn, and all other kinds and products of grain, and, counting commissions, freights, &c., cost the country many dollars more than was realized from its foreign trade in breadstuffs. That this was an exceptionally favorable result is shown by reference to former years, the statistical reports for 1869, for instance, showing a difference against the country upon the exchanges of domestic breadstuffs for foreign sugars of nearly $34,000,000. In a national point of view, it looks as if it would be of advantage to divert a considerable portion of the labor and lands employed in wheat culture to the growth of sugar beets.

There are further economies to be considered. The farmers of this country paid for refined sugar during 1870 the average price of 17 cents per pound, while in France the price of refined sugar is stated by the general report of the Paris exposition to be 10½ cents per pound, a difference to the disadvantage of the American consumer's family of $15 a year. It is further of grave consequence that the use of sugars in this country is greatly restricted by their excessive cost, and a fall of 50 per cent. would probably quadruple their consumption, thus giving to the American product four times as great a market as that which foreign sugars supply. The annual consumption of sugar in France has risen from an average of two pounds for each person, in 1830, to an average of fourteen pounds, in 1865.

The prospect thus opened to the American agriculturist is almost boundless, and the incidental benefits of this industry are nearly as great as its direct rewards. The cultivation of the sugar beet has redeemed large districts of Europe from comparative barrenness. The factory must be near to the farm, and while its labors build up villages and give employment in the winter season to the tillers of the soil, its refuse fattens cattle and manures the land. In France, in addition to its sugar product, the beet is now employed in the manufacture of alcohol, almost to the exclusion of fruits and grain, thus effecting a great economy of food; and in large districts beet culture has doubled the product of wheat, and has increased to five times in number the cattle owned by the people, while effecting a proportional improvement in quality.

It cannot be doubted that this industry can be prosecuted with success in the United States. Experiments have shown that the sugar-beet can be produced in large quantities and of exceptional richness in a number of States; and efforts in the manufacture of sugar have been made not only a scientific but also a commercial success.

At the beginning of the present century the process was little more advanced in France than it now is in this country. In 1810 cane sugar reached the enormous price of sixty cents per pound in France, and the possibility of self-supply became a question of national importance. It attracted the attention of the Emperor Napoleon, and the originator of national expositions used such vigorous measures as insured the success of this new industry. He set apart large tracts of land to the culture of beets, and devoted a million of francs to its encouragement. Schools were established in which the process of manufacture was taught, and domestic sugar was exempt from taxation. These measures, followed by the imposition of heavy duties on imported sugars, gave the

industry firm footing, and since attaining its present dimensions it is a source of considerable revenue to the government. Successful in France, it spread rapidly into Austria and Prussia; and in Russia, Holland, Belgium, and Sweden it has attained to importance.

Mr. Henry F. Q. D'Aligny, United States commissioner to the Paris exposition, whose report upon beet sugar is of great value, says: "The rapid growth and development of this industry throughout Europe forms one of the most interesting spectacles of the present century, and the economic, social, and industrial questions to which it has given rise have attracted the attention and monopolized the labors of the leading minds of the countries in which it has been established. The beet has found its supporters and adherents in the cabinets of kings, the academies of science, in agricultural societies and farmers' clubs, in the machine-shop, and in the peasant's cottage. No other industry of modern times has so successfully harmonized the agricultural and manufacturing interests, which have heretofore been regarded as inimical to each other, or has originated and supported so many subservient and minor interests."

When this country is as much in earnest about the matter as other countries have been, the manufacture of beet-sugar will be a success. One of the most important results of the Paris exposition is its effective presentation of this subject to the American people; and it is to be hoped that a number of States will exhibit beet-sugar in the centennial exposition, and that American invention will improve upon the foreign manufacturing process, which, as now pursued, involves the outlay of considerable capital.

The influences of the world's fair of 1851 and the Paris exposition of 1867 were most directly exerted upon manufacturing industry. The London fair left in the minds of the English people a comfortable sense of the superiority of the metallic and textile fabrics of Great Britain over those of other countries. France and other continental nations saw this plainly, and not only had the good sense to adopt English models and processes, but were capable of improving upon them. While England stood still contentedly, they were making rapid progress, and the result was that in the Paris exposition England fell to the eighth place in the percentages of awards. This revelation of comparative inferiority was a shock to the English nation, which manifested itself in intense expressions of alarm, anxious inquiries into its causes, and search for remedies.

The direct influence of these industrial expositions upon agriculture is displayed in their history and literature. It will not be questioned that their indirect influence has been largely beneficial. Agriculture is benefitted by all other culture. The establishment or development of any manufacturing industry benefits the farmer by cheapening what he wants to buy, and by making a better market for that which he has to sell.

Recognizing the direct and indirect benefits flowing from international industrial expositions in the past, we turn from their study to look forward to the coming centennial exhibition with confidence. What can agriculture do for our grand national *fête* to which the world is invited? what can it do for agriculture? The proposed answer to these questions is: make an exposition of industries which shall be, on our side, distinctively American, and in every sense worthy of our country.

Competitive exhibitions have, in the United States, belonged especially to the sphere of agriculture, and their management by voluntary associations has been uniformly successful. Having attained to their

largest expression in State agricultural fairs, there have been latterly indications of degeneracy, and to some extent a perversion from their true functions. The centennial exhibition suggests for them a new purpose, and will inspire and organize reform. It will be a national exposition of agriculture, with opportunity for inter-state competition. The constitution of the centennial commission suggests, or makes necessary, this form of organization. In it the States are separately and equally represented, and while the commission has national character and general functions, by virtue of national recognition, the fact that it is a congress of State representatives must impose upon its members special duties, and give form and character to the exposition. Tolerably well-informed Americans, and very intelligent English people, have but vague and inaccurate ideas of the resources and distinguishing characteristics of the several States of the Union, while in other countries, possessing a different language and literature, accurate knowledge of these matters must be confined to a very few persons. To our transatlantic visitors the centennial exhibition will adequately express and individualize the United States of America.

It will be the duty of the national centennial commission to settle forms of classification of all articles which may be exhibited, and it is desirable that these forms should be published as soon as possible. Its classification of the products of agriculture should be, as far as is practicable, adopted by all township, county, and State agricultural societies, whose fairs thenceforth would become preparatory studies for the centennial exposition. Every agricultural society should have its centennial committee, charged with the special duties of acquiring and diffusing information concerning the methods and progress of the national exhibition, and of bringing forward worthy competitors for the prizes which it will offer. By a system of representation carried into the State centennial committees belonging to the State agricultural societies, every interest and locality would be cared for and stimulated to excellence.

The uniform superiority manifested by France in the Paris exposition is, in part, attributable to a preliminary official scrutiny, which excluded all articles unfit for exhibition. The American people would not submit to such governmental interference; but, so far as agricultural products are concerned, we have, fortunately, a method of attaining the same end without exciting jealousy. The labors of the centennial committees of the agricultural societies would naturally culminate in the establishment of a new order of prizes, to be awarded by subordinate and State committees to exhibitors of articles of superior merit, which would place them, free of cost to the exhibitor, in the States' department of the centennial exhibition, or would make proportional contribution to this purpose.

A definite portion of space in the exposition must be set apart to each State and to each group or class of articles exhibited; and there must be somewhere lodged a power of selection which will exclude redundancies, unless the whole matter is left to chance. The plan herein suggested will effect this purpose; for, though it leaves every one free to offer for exhibition what he pleases, it will generally decide the selection, and all complaints of injustice may be averted by giving a right of appeal from subordinate to superior committees.

This plan involves the important incidental benefits of a more thorough and perfect development of the existing voluntary agricultural associations, and the added efficiency which they will gain from systematic preparation for inter-state competition in the national department of the exposition, and from recognition as State centennial

agencies, within their sphere. These influences would be greatly strengthened if the national commission should offer a place in their highest order of recompenses to the State which presents the most efficient organizations, voluntary and governmental, for the promotion of agriculture.

The method of exhibiting the agricultural groups, adopted by the Paris exposition, as well as their classification, is deserving of notice. Group 8, consisting of "live stock and specimens of agricultural buildings," contained eight classes, viz: farm buildings and agricultural works; horses, asses, and mules; bulls, buffaloes, &c.; sheep and goats; pigs and rabbits; poultry; sporting-dogs and watch-dogs; useful insects; fish, &c. These classes were shown upon the island of Billancourt, in a series of exhibitions, renewed every fortnight, and arranged as follows:

April.—First fortnight, plows, hydraulic machines, and steam-engines. Second fortnight, steam plows, harrows, rollers, &c.

May.—First fortnight, drills, vehicles, harness, churns, and utensils. Second fortnight, mowing and winnowing machines, rakes, hay-making apparatus, &c.

June.—First fortnight, competition in farming and examination of specimens of rural establishments. Second fortnight, chaff and root-cutters, horse-hoes, mills, &c.

July.—First fortnight, apparatus for clipping domestic animals. Second fortnight, hoisting-machines and apparatus.

August.—First fortnight, threshing-machines and apparatus for cleaning and preserving grain. Second fortnight, portable ovens, apparatus for cooking vegetables, washing linen, and manufacturing manures.

September and October.—Examination of various agricultural industries.

The exhibition of animals, arranged in the same manner as that of farm implements, began with breeding sheep, in the first fortnight of April, and changed fortnightly, in the following order: Fat animals, dairy cattle, and breeders; sheep for wool and breeders; horses and other animals for draught; poultry and small animals; cattle for labor and breeders; saddle-horses, hunters, ponies, &c.; dogs, draught-oxen; pigs and breeders; asses, mules, &c.; fat animals; animals acclimatized or capable of becoming so.

The exhibition of group 9, consisting of live produce and horticultural works, was made in fourteen competitive series, succeeding each other fortnightly, as in group 8, and is so minutely and fully catalogued that a satisfactory condensation is impracticable. Beginning April 1, there was a principal exhibition of flowers and fruits, and a minor exhibition of every kind of useful or ornamental shrub, plant, tree, fruit, or vegetable which would then be in perfection, concluding with a principal exhibition in October of all kinds of vegetables.

A similar system of alternating exhibitions will necessarily be adopted by the centennial commission, for in no other way can the perishable products of the earth be shown, and in the department of machinery, &c., it will effect a needed economy of space while ministering to the convenience and profit of exhibitors and visitors. There should be careful discrimination of indigenous and exotic varieties of plants, fruits, and flowers; and a prize should be offered for the largest and most complete collection of native varieties in each class. Indeed, this should be throughout a trait of the agricultural side of the exposition, and it will have not only an industrial but also a scientific interest. It will be a pleasure to see what varieties of plants and animals have originated within the United States, or what plants have been produced by skillful

cultivation, as also to see what improvement or new qualities foreign varieties have taken from acclimatization, and the care bestowed upon them. European countries exhibited at Paris specimens of wheat and corn grown from well-known American varieties. The centennial exhibition may show large progress in this direction, and testify to the mutual benefits resulting from the system of international exchanges of seeds and plants conducted by this Department.

In the exhibition of live stock it will appear that the finest and purest specimens of noted foreign strains have been sought for, regardless of cost, by our breeders. While this will greatly redound to our honor, it will be less interesting and profitable to our foreign visitors than the exhibition which can be made of the finest specimens of domestic animals which are of native origin or of lineage too obscure to be traced. Cattle of foreign origin and pure blood are most interesting to us, because of peculiarities of form and character; and careful breeding for many generations has necessarily imparted to them special excellencies, which are often accompanied with as marked defects. An added value to the peculiar excellence of pure breeds consists in that it is a fixed quantity, and may be employed as a factor with the certainty of a definite product. The great worth of this quality has been so plainly manifested in imported stock that many persons believe that whatever is of value must necessarily have come from abroad, and would credit to some obscure foreign parentage every marked excellence. While the acclimatization of exotics is of very great and often paramount usefulness, as is shown in the gift of Indian corn and the potato by America to Europe, and the acquisition by this country of the merino sheep, it must be generally true that the stock of each country will possess certain characteristics best adapted to its own propagation and preservation, involving qualities most useful to man. This may be safely illustrated by the common milk-cow of the American farmer, which, as a feeder and breeder and a producer of milk and beef, is generally more serviceable and profitable than any imported stock. The same thing may be said most emphatically of the horses of native strain, which the really well-to-do American farmer relies upon for general service. What might be accomplished with such stock, by means of generous treatment and careful breeding, has not yet been determined; and in this regard our farmers owe to their country an important duty which they have not discharged. In the four years yet to elapse this suggestion may be acted upon, and an exhibition may be made of native stock which will do honor to the country. Superior excellence has never been attained or perpetuated anywhere, except through conscientious efforts to improve the good gifts which nature freely offers.

Should the centennial commission adopt a plan similar to that of the Paris exposition, which will exhibit in one view the various products of each State, and render a comparison of one State with another easy, there will be an admirable opportunity for observing the influence which the arts and industries mutually exert upon each other. In comparing the United States with foreign countries, or one foreign country with another, differences of laws, habits, modes of living, race, &c., enter as unknown quantities of potential, but indefinite influence, casting doubt upon all conclusions. The different States of the American Union have laws of substantial uniformity; while they have a mixture of races there is but one people; and such differences as appear between the purely agricultural States and those which have combined agricultural and manufacturing industry will be attributed to their true cause. The

effort which each State will make to exhibit various excellencies will secure a full representation of all its industries, and do more to demonstrate the harmony of interests than all the essays ever written upon the subject.

Organization of the national department of the exposition in the form of states united will simplify the labors of administration in so many ways that we may well believe the commission will either adopt the plan of the Paris building or something which will not differ widely from it. In addition to presenting their products, it will be of importance to the States to exhibit in all practicable ways, pictorial, graphic, statistical, and literary, the material facts which will define their politic, economic, and social characteristics. The amount of arable land and the proportion under cultivation, the extent of forests, mountain ranges, artificial roads of every kind, and navigable water-courses, should be strikingly exhibited by maps, and photographic views might be made of scenes or objects of peculiar interest. The price and quality of all lands open to settlement may be advertised to great advantage, as well as the cost of improved and unimproved farms, the wages of labor in different occupations, and the value of all kinds of products.

It has already been suggested that each State should exhibit its organizations, voluntary and governmental, for the advancement of agriculture, which would include farmers' clubs and agricultural societies, State boards and departments of agriculture, and State agricultural societies, agricultural schools and colleges, experimental farms under public or governmental control, &c. In like manner, the common-school systems and all public educational institutions should be exhibited, with photographs of buildings, statistics of expense, professorships, numbers of scholars and teachers, and books and apparatus. Public libraries will, of course, have prominent place among educational institutions, and lyceum and lecture associations should not be forgotten. In short, we would have the people of the different States exhibit not only the fruits of their labors, but also their lives, the material, moral, and spiritual constituents and concomitants of American citizenship.

After ingenuity has exhausted itself in making the fullest possible exposition of the United States, at Philadelphia, other means must be employed to give to foreigners a true idea of the extent of our country, and to enable them to witness some novel and interesting phases of American industry. Intelligent visitors to the centennial exhibition, having the means, will be inclined to travel and see something of the country, but this should not be depended upon, and travel should be organized as a part of its business.

If, as we have suggested, thorough organization of centennial committees within existing agricultural societies can be effected, unless it is deemed incompatible with the international character of the exhibition, there will be no practical difficulty in awarding prizes for growing crops, plantations, farms, and agricultural establishments in the United States, after actual inspection by an international jury. Such a jury service would be the most attractive official duty pertaining to the exposition, and the best representatives of foreign countries would gladly accept a place upon it.

To such intelligent observers it would be profitable to exhibit a cotton-field in full bloom, a five thousand acre field of wheat, a ten thousand acre corn-field provided with a corn-crib twelve feet wide and five miles long, filled at harvest to the height of eight feet with corn; a cattle rancho embracing eighty thousand acres and stocked with 65,000 cattle, 10,000 horses, and 15,000 sheep and goats; the factories which make the

cheese now so largely exported to Europe; a butter factory consuming the milk of a thousand cows; a peach orchard containing 136,000 trees in full bearing; breeding-farms selling $200,000 worth of pure blooded stock annually; and other things of like character, possessing distinguished merit. If this department of the exposition is made to take the form of inter-state competition strictly, the work of the jury will be simplified by the preliminary contests under the auspices of the State agricultural societies, which will elect the competitors for the centennial prizes, and there will be no more travel required than will be agreeable, and attended with profit. It seems to be exceedingly desirable that there should be such provision for official travel as we have suggested, and, in addition to this, each State should have a bureau of travel connected with its department of the exposition, which would be enabled, by means of special arrangements with railroad and hotel companies, to organize travel to and from the exposition, for the benefit of visitors from abroad and home exhibitors and visitors, in such way that expenses would be reduced much below usual rates, and strangers would be assured of comforts and courtesies upon the route. The use of this as an economy and in promoting the success of the exposition must be apparent, and its advantages to immigrants and as a method of procuring immigration should also be manifest.

In the Paris exposition all articles exhibited were allowed to be marked with a price, and under proper restrictions to be sold, thus giving the fair a commercial character, which added to its attraction and enlarged its usefulness. A similar regulation should be adopted by the centennial commission, as it would offer additional inducements to foreign exhibitors. They will not generally care to carry home anything but the prizes they may receive, and will be glad to sell at a just price things which may be costly to transport and liable to damage or loss. There will be little danger that articles will be sent to the exposition from abroad, not as specimens of excellence in the arts and industries, but merely for a market, because foreign governments may be trusted to exercise a rigid scrutiny in the matter, and will not allow national interests to be subordinated to individual profit. We may be certain that the best seeds, plants, animals, and all agricultural products of foreign countries will, at the close of the exposition, remain in the United States. Whether this commercial feature of the exposition should be extended to home exhibitors is matter for grave consideration. In case it is so extended, the importance of such preliminary scrutiny as we have proposed to give to the centennial committees of the agricultural societies becomes at once apparent, and we may hope that through the organized trades the same principle of selection may be extended to other industries.

The memorial character of the centennial exhibition suggests a retrospective view of the progress of agriculture, of which we should seek in every way to make adequate presentation. In a general way this could be strikingly exhibited by maps showing the area of cultivation in 1776 and 1876. At the former date, the western boundaries of the thirteen original States were a wild and savage frontier, and the emigration of adventurous spirits to the wilderness was to western New York and eastern Ohio. Then the country was bounded westward by the Mississippi; now it extends from ocean to ocean. Twenty-five or more States which will bear their treasures to the exposition then had no existence. Then the wolf's long howl was heard on shores which now bear some of the most important commercial cities of the world, and this vast empire with its inestimable riches of every sort has been conquered from the wilderness by agricultural industry.

Taking an idea from the Paris exposition, would it not be profitable to have a department exhibiting a history of American agricultural labor? It has to go back but a hundred years for its antiquities. Would it not be possible to show the plows, hoes, shovels, rakes, axes, forks, and other agricultural implements of our revolutionary fathers, together with the various transformations they have undergone in attaining the most approved forms of the present time? If authentic specimens of antiquity cannot be found they may be reconstructed in accordance with tradition, aided by such hints as can be borrowed from remote Sleepy Hollow regions, which are a hundred years behind the age. Farming tools as rude as those of our ancestors are still used in the cultivation of the soil in countries to which American agricultural implements are not exported. It will not be surprising if such an exhibition as we have suggested should be contributed by and claimed as a triumph of manufacturing industry. In presence of it the American farmer and artisan may clasp hands, and agree in recognizing that they have a common and undistinguishable history, progress, and prosperity.

At the Paris exposition the State of Illinois exhibited a western farmer's home—such a comfortable wooden building, with modern conveniences, as any well-to-do farmer may own—which was set up with other types of residences and palaces in the Champs de Mars, and attracted a great deal of attention. It would have added somewhat to the interest to have had set up beside it the chinked and daubed log-cabin of the first settler, with its chimney of sticks and mud, clap-board roof, puncheon floor, and door with the latch-string out; and its successor, the comfortable two-story house, built of squared logs, with glass windows, and other modern conveniences. Such a record of the progressive improvement in rural homes might be exhibited at Philadelphia, precisely as it may be seen on some old farms of the original States, where the grandfather's cabin still does duty as a calf-pen, and the log-house of the father has become a dry-house, store-room, or cow-stable, while the grandson lives in a wooden or brick dwelling of handsome style, and possessing all sorts of conveniences. In this series of dwellings is exhibited in one view the history of a century of progress. We would have these more and less ancient dwellings set up in Fairmount Park and inhabited by the backwoodsman and farmer, with their families, in the costumes appropriate to the times they represent. It would be interesting to see the first settler—the man of the wilderness—half-farmer and half-hunter, in his buck-skin breeches and hunting-shirt, stirring his stumpy little patch of ground with a pair of balky steers and a shovel-plow to plant his corn; and then throwing his rifle on his shoulder and starting out to bring in a deer, while his wife, in a costume as antiquated as her husband's, entertained wandering barbarians, Scythians, and pagans, with buckwheat cakes and honey.

The farmer of more modern date and his family would be quite as novel and pleasant a spectacle, going about their business in substantial homespun dresses of flax and wool, the manufacture of which, in its various processes, they could exhibit, while they offered cider and apples to their neighborly visitors.

Consideration of the questions, "What can agriculture do for the centennial celebration and exposition of industries?—what can it do for agriculture?"—enlarges our thoughts, until we conceive of the centennial as agriculture's golden opportunity, and the greatest event of the age. Agriculture can do nothing for the centennial exhibition which will not bring it presently a tenfold reward.

The farmers of the United States outnumber by far the workers in all other industries. They are deeply imbued with patriotism, and have never failed to respond to the calls of their country. It calls upon them now. Our country has been the honored guest of other nations, and has borne away prizes in friendly contests with them. It is now our duty to play the host in turn; and national honor demands that the entertainment we offer shall be worthy of our guests, and shall fitly celebrate the centennial anniversary of the American republic.

PROGRESS OF INDUSTRIAL EDUCATION

There are now thirty-two industrial colleges and universities in the United States which have received the national endowment made by Congress under the act of July 2, 1862. Massachusetts has two, Mississippi two, and each of the other States one, except Florida, Louisiana, Nevada, and Virginia, in which none have yet been established. Twenty-six of these institutions are in operation, and it is expected that the remainder will be opened during the year 1872. Twenty are established in connection with other institutions, and seventeen are independent colleges. Three hundred and ten professors and assistants are employed in giving instruction to more than two thousand students who are pursuing a regular course of study in agriculture and the mechanic arts. Quite a number have already completed the required course of three or four years, and have received diplomas. A large portion of these students are educated free of expense for tuition. These institutions have excited the attention not only of the National Government and of the States, but also of private individuals. Several gentlemen and ladies of distinguished liberality, who have had in view the laudable object of improving the industrial education of the nation, have made liberal donations for their support, as may be learned from the following summary of their progress and the table appended:

ALABAMA.

By an act of the legislature, approved December 31, 1868, Alabama accepted the land-scrip granted to it under the act of Congress of July 2, 1862. The scrip has been sold for $216,000. The Agricultural and Mechanical College of Alabama was incorporated February 26, 1872. Rev. I. T. Ticknor has been elected president.

ARKANSAS.

This State accepted the congressional land-scrip grant of 150,000 acres January 31, 1867, but the land has not yet been delivered. The legislature incorporated the Arkansas Industrial University on the 27th of March, 1871, and made an appropriation of $50,000 for its benefit. Washington County gave $100,000 in 8 per cent. bonds for thirty years, and the town of Fayetteville, in which the university is located, gave $30,000 in bonds, bearing the same interest and for the same time. Four hundred acres of land, valued at $2,000, have been donated by private individuals. The locality of the university is especially noted for the fertility of its soil, the salubrity of its climate, and its adaptability to the perfect growth of agricultural and horticultural

productions. A fine lot of land, containing 160 acres, has been purchased in and adjacent to Fayetteville, for the location of the university buildings, and for an experimental farm. Temporary buildings have been provided for the accommodation of all the students who may apply at the opening of the university, which will take place on the 22d of January, 1872.* Provision has been made for new buildings, and the trustees will commence the erection of the new university immediately. According to the plan the front will be 170 feet, and the depth 100 feet. The main building will be 76 feet high, and to the top of the dome 128 feet. The two wings will be 60 feet high. It is to be built of stone and brick, with Mansard roof, and to be covered with slate, and heated by steam. It will contain a laboratory, library, chapel, and lecture-rooms, and accommodate seven hundred students. The total cost of the edifice will be $120,000. The dormitories and boarding department are to be separate from the university building, and will be erected as soon as practicable.

The aim of the board of trustees is to comply strictly with the acts of Congress and the legislature of the State in providing and establishing the university, and to effect this object it is required "to teach such branches of learning as are related to agriculture and the mechanic arts, without excluding other scientific and classical studies, and including military tactics." A complete course of study will therefore be adopted, and a corps of professors provided previous to the opening of the first term.

Provision is made for two hundred and nineteen beneficiaries from the different counties of the State, who are admitted to the university for a course of study of four years, free of tuition. A matriculation fee of $5 is demanded on entering, after which no further charge is made. They are appointed as follows: By the governor of the State, ten—not to exceed two in any one county; by the superintendent of public instruction, five—not to exceed one in any one county, provided he shall not be entitled to make any appointment by virtue of being *ex-officio* member of the board of trustees; by each member of the board of trustees, four, to be selected from his district. The circuit superintendents of public instruction are authorized to appoint the residue from the several counties of their respective districts. Other students, whether residents or from other States, are required to pay $10 tuition for each term. No distinction of applicants is made with regard to sex or race, and all are required to be at least fourteen years of age when admitted.

Besides the agricultural and mechanical, there are preparatory and normal departments. The academic year is divided into three terms. The fall term commencing on the fourth Monday in September, continues fourteen weeks; the winter term the first Monday in January, thirteen weeks; the spring term on the first Monday after the close of the winter term, thirteen weeks.

CALIFORNIA.

The University of California, at Oakland, has been in operation a little more than two years. It has five colleges organized, and a course of study prescribed for each: The State Colleges, 1, of Agriculture; 2, of Mechanic Arts; 3, of Mines; 4, of Civil Engineering; 5, of Letters. On the 31st of March, 1866, the legislature of the State established a college called "The Agricultural, Mining, and Mechanic Arts College," but the

* See statistical table at the close of this article on the Progress of Industrial Education.

location was not then determined. It was subsequently decided to connect it with the University of California, and the avails of the land granted by Congress for that purpose were appropriated for its support. The university has received several large grants of land and money from the State. Instruction is free in all its departmente except the preparatory, and in that to those who are needy, and its doors are opened alike to individuals of both sexes, who are qualified to profit by its instructions. By an act of the legislature, five scholarships have been established, each of the value of $300 a year, for four years, to be competed for by the candidates for the fourth, or lowest class in the university proper.

The faculty consists of Henry Durant, LL.D., president; Stephen J. Field, LL.D., professor of law; John Le Conte, M. D., of physics and industrial mechanics; Joseph Le Conte, M. D., of geology, natural history, and botany; Martin Kellogg, A. M., of ancient languages; W. T. Welcker, of mathematics; Paul Pioda, of modern languages; Ezra S. Carr, M. D., of agriculture, chemistry, agricultural and applied chemistry, and horticulture; William Swinton, A. M., of the English language and literature, rhetoric, logic, and history; George Davidson, A. M., of astronomy and geodesy; Frank Soule, jr., assistant professor of mathematics; George Tait, A. M., assistant professor of ancient languages and master of the fifth class; Robert E. Ogilby, instructor in drawing.

The course of study in the College of Agriculture is as follows:

FIRST YEAR—FOURTH CLASS.—*First term.*—French, German, Spanish, or Italian; elocution and English composition, history, algebra, drawing. *Second term.*—French, German, Spanish, or Italian; rhetoric and English composition, elocution and private declamation, history, algebra, geometry, physiology and hygiene, drawing. *Third term.*—French, German, Spanish, or Italian; rhetoric and English composition, private declamation, history, natural history, geometry, trigonometry, mensuration, physiology and hygiene, drawing.

SECOND YEAR—THIRD CLASS.—*First term.*—French, German, Spanish, or Italian; rhetoric, public and private declamation, surveying, navigation, physics, (heat,) chemistry, botany, drawing. *Second term.*—French, German, Spanish, or Italian; public and private declamation, analytical geometry, physics, (heat,) chemistry, botany, drawing. *Third term.*—French, German, Spanish, or Italian; public or private declamation; descriptive geometry; shades, shadows, and linear perspective; mechanics, chemistry, zoology, laboratory, drawing.

THIRD YEAR—SECOND CLASS.—*First term.*—Mental philosophy, French, German, Spanish, or Italian; mechanics, differential calculus, (optional,) agricultural chemistry, mineralogy, zoology, horticulture, analytical chemistry, drawing. *Second term.*—Mental philosophy, French, German, Spanish, or Italian; belles-lettres, mechanics, (liquids and gases,) differential calculus, (optional,) integral calculus, (optional,) agricultural chemistry, zoology, horticulture, analytical chemistry, drawing. *Third term.*—French, German, Spanish, or Italian; belles-lettres, physics, (electricity and magnetism,) integral calculus and calculus of variations, (optional,) geology, agriculture, laboratory practice, drawing.

FOURTH YEAR—FIRST CLASS.—*First term.*—Moral philosophy, physics, (acoustics and optics,) geology, agriculture, veterinary science, rural economy, laboratory practice. *Second term.*—Moral philosophy, political economy, physics, (optics,) geology, diseases of animals and plants, laboratory practice. *Third term.*—Political economy, international law, (lectures,) natural theology, meteorology, forestry, laboratory practice.

The courses in the Colleges of Mechanic Arts, of Mining, of Civil Engineering, and of Letters are equally exhaustive. The library contains 3,000 volumes. The number of students in attendance in all the departments during the scholastic year ending in July, 1871, was 262.

CONNECTICUT.

The Sheffield Scientific School of Yale College, at New Haven, Rev. Noah Porter, D. D., LL. D., president, has recently made an effort to raise an endowment fund sufficient to meet the immediate wants of the school. Meetings were held in different places to present the subject to the people, and about half the sum proposed to be raised has been contributed, principally by gentlemen in New Haven and New York. By the aid of a part of the revenue derived from this fund, two professors, previously on partial pay, have been placed on full salary; a new professor, William P. Trowbridge, has been added to the faculty, and the number of assistants increased. The school now sustains thirteen professors and twelve assistants and lecturers. As it has recently received liberal donations, it is hoped and believed that, in a short time, the whole amount proposed for its endowment will be collected.

Mr. Joseph Sampson, of New York, gave $3,000 to purchase the famous mineral collection of pseudomorphs made by Professor Blum, of Heidelberg. This collection embraces over 1,700 specimens, and is the most extensive cabinet of the kind in existence, being the work of thirty-eight years of enthusiastic devotion to this specialty. Many valuable collections of fossils were made during the last summer by the Yale College expedition to the Rocky Mountains. These collections contain more than 10,000 specimens of fossils and at least fifty species of extinct animals previously unknown to science. By the aid of the recent endowment fund additions to the amount of $600 have been made to the physical apparatus, in the branches of heat, pneumatics, optics, electricity, and mechanics. Other generous donations have been received from persons in New Haven and other places. This school has no experimental farm on which practical instruction in agriculture can be given, but it hopes to ground its students so thoroughly in the science of agriculture that the practical part may be easily acquired, and the whole subject thoroughly comprehended. It has already sent forth some of the most valuable works on agriculture and kindred subjects that have been published in this country.

The number of pupils during the scholastic year ending in July, 1871, is 123, of whom 22 are post graduates, 93 under graduates, and 8 special students.

DELAWARE.

Delaware College, at Newark, William H. Purnell, A. M., president, is pleasantly located at the head of the peninsula formed by the Chesapeake and Delaware Bays, and from its retired position in a mild climate presents unusual attractions as a place for agreeable and profitable study. Its land-scrip, consisting of 90,000 acres, was sold for $78,400, from which an annual income of about $4,992 is derived. By additions from other sources the fund has been increased to $83,200. The value of the library and apparatus is estimated to be $6,000, and of the college buildings $50,000. It has been open for the reception of students since its suspension in 1859, only a little more than one year. There are now six professors, and the number of students in attendance during the year ending in July, 1871, was 30. Stu-

dents must be at least fourteen years of age to enter upon the studies of the agricultural course.

FLORIDA.

Florida accepted the congressional grant of land-scrip January 30, 1869, and was entitled to 90,000 acres. The scrip has not yet been delivered, and no agricultural college has been established in the State.

GEORGIA.

This State accepted the congressional grant of land-scrip March 10, 1866, receiving 270,000 acres. By an act of the legislature "to provide a college for the benefit of agriculture and the mechanic arts in the State of Georgia," approved December 12, 1866, the governor of the State was authorized to receive and sell the land-scrip to which the State was entitled, to invest the proceeds in bonds of the State, and to disburse the interest on the investment for the support and maintenance of the college, and to provide rules and regulations for the organization, government, and operation of the same until the next ensuing session of the general assembly. The land-scrip came into the possession of the State in the latter part of 1871. The Georgia State College of Agriculture and Mechanic Arts, at Athens, was incorporated March 30, 1872. W. Le Roy Brown is president.

ILLINOIS.

The Illinois Industrial University, at Urbana, John M. Gregory, LL.D., regent, is expanding into an institution of the highest order. In 1869 the legislature of the State appropriated $25,000 to the agricultural department for barns, tools, and stock; $20,000 to the horticultural department for a greenhouse, barns, drainage, trees, and tools; $5,000 to the chemical laboratory; $10,000 for library and apparatus; and the present legislature has appropriated $75,000 to begin the erection of a new university building, which is to cost $150,000; $35,000 for a mechanical building and machinery, to include a large drill-hall for a military department; and $10,000 for the library. Besides its farm and horticultural lands, (623 acres,) and buildings, the whole being valued at $216,000, the university owns 25,000 acres of well-selected lands in Minnesota and Nebraska, endowment funds invested in State and county bonds amounting to $364,000, and other property worth $50,000. Plans of these new buildings have been adopted, and the erection of them is to begin at once. The new university building is to be 214 feet in length, three stories high, besides the basement and Mansard roof, with wings extending back 124 feet. It will contain a large public hall for chapel and general exercises, large drawing-rooms, and thirty class and lecture rooms, sufficiently large for the instruction of 1,000 to 1,200 students. In one wing, to be made fire-proof, will be a spacious library and reading-hall, and large and commodious rooms for museums of natural history and the useful arts. Several large rooms for literary societies will also be provided in the Mansard story. The building is surmounted by campanile towers for clock and bells.

The new "mechanical building and drill-hall" is to be 128 feet in length by 80 feet in width, two stories in height, with towers. It will contain a boiler and forge-room, machine-shop, shops for patterns and finishing, carpentry, cabinet-work, wood-making machinery, also rooms for painting, printing, draughting, models, finishing, &c. In the second

story will be a large drill-hall 120 feet by 60 feet. On the ground floor of one of the towers will be an armorer's shop, a band-room, officers' rooms, and a military model-room. There are to be two greenhouses, one 70 feet in length by 24 in width, exclusive of the wing containing potting, seed, and furnace-rooms; the other 35 feet by 12. The veterinary stables and operating rooms are to occupy the old buildings previously used for shops. A good yard and sheds will be fitted up for practical instruction in the care and treatment of sick animals, which, during the fall or winter terms, are to be brought to these stables for treatment.

There are three barns belonging to the stock and experimental farms and gardens, and three dwelling-houses for the superintendents. The stock farm is well supplied with farm machinery and tools, and a stock of several breeds of neat-cattle, sheep, and swine will be purchased at an early day. The horticultural grounds include 130 acres, 20 of which are planted with forest-trees, 10 acres are devoted to ornamental grounds, and several to nurseries and large garden plats. Nearly 1,000 apple-trees have been added to the orchard since last year, increasing the number from 2,193 to 3,000 trees, embracing about 1,400 varieties. The pear-orchard contains about 400 varieties. There are also two greenhouses on the grounds, well filled with rare exotic and flowering plants. During the year 1,000 volumes have been added to the library, making 5,000 volumes in all.

The university has ten professors, with five assistant teachers, and four assistants on the farm and in the garden and workshops. The number of students in the university for the year ending in June, 1871, is 277, being an increase of 81 over the last year. Of these 63 were in the agricultural department, 39 in the mechanical, 22 in the civil engineering, 2 in the civil and mining engineering, 4 in the architectural engineering, 11 in the chemical, 26 in the military, and 110 unassigned to any department. Of the whole number, 23 were females. Further details of this university may be found in the reports of the Department for 1867, 1868, 1869, and 1870.

INDIANA.

The Indiana Agricultural College, a branch of Purdue University, Governor Conrad Baker, president of the trustees, and John M. Stein, secretary, was located at La Fayette, Tippecanoe County, in 1869. A tract of land containing 100 acres has been furnished for the site of the college buildings and for the experimental farm, and a contract has been made for erecting the main edifice. The foundation is already laid, and it is expected that the building will be completed and ready for occupancy by the 1st of December, 1872. The Congressional land-scrip, amounting to 390,000 acres, was sold in 1867 for $212,238.50, and the interest since accrued amounts to $70,371.06, making a total of $282,609.56 derived from the national grant. This money is invested principally in United States bonds. Mr. John Purdue gave $150,000, and Tippecanoe County $50,000. These several sums, with the $40,000 at which the farm is valued, amount to $522,609.56 as the total fund of the college. The annual income is $17,500.

IOWA.

The Iowa State Agricultural College, at Ames, A. S. Welch, LL.D., president, exhibits a marked degree of prosperity. The number of professors and assistants has increased from nine in 1869 to thirteen in 1871, and the students from one hundred and ninety-two to two hundred and

twenty in the same period. The labor system proves to be a great success. The farm now contains 838 acres, and affords ample facilities for practical as well as scientific education in the field. As this institution is entirely disconnected with any university, a good opportunity is afforded to test the wisdom or folly of such a separation. The advantages offered to the students for books of reference and apparatus for illustration of subjects taught are excellent. The library and apparatus are valued at $11,000, and the college buildings at $214,000. Although none of the land granted by Congress has been sold, the percentage of income from its rent, amounting to $31,000, enables the college to pay its professors liberally. Further particulars in reference to this college may be found in the reports of the Department for 1867, 1869, and 1870.

KANSAS.

The regents of Kansas State Agricultural College, at Manhattan, Rev Joseph Denison, D. D., president, have made an effort this year to enlarge the college farm, and by the aid of $12,000, given by the township of Manhattan, and a part of an appropriation made by the legislature in 1870, they were enabled to purchase 315 acres of excellent land, 155 of which adjoin the town-site of Manhattan. The home farm of the college contains 415 acres of high prairie, creek bottom, and second bottom soil—thus affording all the varieties necessary for experimenting with the various plants under cultivation. Nearly all this land is fenced and cultivated. Over thirty acres were planted with corn the last season. The farm is under the superintendence of the professor of agriculture, who gives practical lessons in the field to illustrate the principles taught in the recitation-room. A system of educational class-labor has been organized by dividing the students into divisions of eight or ten each, with a leader, and requiring one hour of labor each day on Mondays and Thursdays; additional labor being voluntary, and paid for by the hour. An hour on Tuesdays and Fridays is devoted to military drill, and on Wednesdays to lectures by the professors.

The orchards on the farm contain 1,000 apple trees, and about the same number of peach trees, with a full assortment of fruits. There are 40,000 trees of different kinds in the nursery; and the vineyard covers nearly three acres. Practical instruction in horticulture is given to the students by the superintendent of the nursery. The college employs an English stock-breeder, and as soon as practicable a spacious barn will be built, and a herd of thorough-bred animals purchased for improved stock-breeding.

The educational force of the college consists of seven professors, three teachers, and two lecturers—Dr. John A. Warder on horticulture and pomology, and Charles V. Riley on economic entomology. In January the professors held an agricultural institute, which was largely attended by farmers and others, and proved the great utility of such meetings. The number of students in attendance the present college year is 194, exceeding that of the previous year by 26. Of these, 30 are in the agricultural and literary course, 4 in the scientific and collegiate course, and 160 in the preparatory department. Sixteen of those in the first two courses named are ladies. The college has already supplied over one hundred teachers for the different schools in the State.

The national endowment fund, reckoning land unsold at $5 per acre, now amounts to $378,542.

KENTUCKY.

The Agricultural and Mechanical College in Kentucky University, J. B. Bowman, A. M., regent, has enjoyed its usual prosperity during the year, with the exception of the destruction of all its greenhouses and plants by fire, causing a very heavy loss to the institution. The collection of these plants had been the work of several years. A temporary greenhouse, however, has been erected, and about 1,000 plants collected as the nucleus for a new stock. The regular classes in the various colleges have been larger than ever before, and the number of young men who purpose to graduate is increasing. Thirty professors and instructors have been employed in the university during the year. The number of students is 660, of whom 212 are in the agricultural and mechanical college. Although the regular classes are fuller, the whole number of students is a little less than last year. This is owing to the fact that the academy, which previously swelled the number of matriculates, has been abolished; and also because a large number were refused admittance into the agricultural and mechanical college for want of means on their part, and of working capital, necessary to give them employment on the farm or in the workshops. During the year, about 350 students of the university have received free tuition, and about 100 the benefits of the compensated labor system. Several young men in the agricultural and mechanical college are, in a measure, supporting themselves by daily labor on the farm and in the workshops, at the same time carrying on three to four studies, and making regular daily recitations. The energy and zeal which most of the students have displayed in the acquisition of knowledge, the fraternal spirit evinced in their inter-association in the various colleges, and their manly bearing and orderly behavior in the community have commanded the praise of all. About 500 volumes have been added to the library during the year. The experimental and model farm, and the horticultural and mechanical departments have been improving. The cash receipts during the year for milk from an average of twenty cows have been $2,500. The number of cows has been increased, and the results will be much larger for the next year.

The total value of the university fund is $433,700, and the annual income $35,000. The buildings are worth $350,000; the library and apparatus, $25,000.

LOUISIANA.

This state sold the land-scrip granted to it by Congress for 87 cents per acre, which amounted to $182,630.40. The money was invested in Louisiana 6 per cent. bonds, which were purchased at 61 to 64 cents on a dollar, and amounted, when reckoned at their par value, to $286,000. The interest on their par value is now promptly paid by the State semi-annually. It is contemplated to invest a sufficient amount of the interest about to become due to make an additional purchase of $14,000 worth of bonds, which will increase the fund to $300,000. This principal is to be held inviolate, and the interest to be applied to the maintenance of a college of agriculture and the mechanic arts.

MAINE.

The Maine State College of Agriculture and the Mechanic Arts, at Orono, Rev. Charles F. Allen, A. M., president, has made important progress during this and the previous year. An embarrassment in respect to the title of the land conveyed to the college by the town of Orono has been removed, and the appropriation of $50,000 made by the

State upon certain conditions depending upon this title, has been placed at the disposal of the trustees. The portion of the land donated by Congress, which had been reserved at the first sale, has been sold at 84 cents per acre, and the proceeds invested in State of Maine 6 per cent. bonds, to the amount of $13,600. The fund derived from the sale of all the land-scrip granted to the college by Congress now amounts to $134,300, and the annual interest from the same is $8,458. The chemical laboratory, which was commenced in 1868, a building two stories high and 50 by 40 feet on the ground, with an L 54 by 38 feet, is now completed in a very thorough and substantial manner. It contains an analytical-laboratory room, occupying the entire floor of the L, well furnished, and sufficiently large to accommodate a class of fifty students; a large lecture-room on the second floor of the main building, connected with which are two preparation-rooms, or rooms for private laboratories for the professors; a room for chemical apparatus, and a room for a chemical library. There are also two additional rooms, one of which for the present will be used for the philosophical apparatus, and the other for a mineralogical cabinet. All the rooms are completely furnished with the necessary apparatus, and an arrangement entirely new in this country has been adopted for carrying off the noxious gases from the working laboratory. For thoroughness of construction, completeness of interior appointments, and adaptation to the purposes for which it was designed, this laboratory is believed to be fully equal to those of the best institutions of the kind in this country. A new dormitory, 83 by 42 feet, and a boarding-house 50 by 30 feet, have recently been built, by which accommodation is now furnished for 125 students. The curriculum of study has been revised, and the board of instruction completely re-organized. Great prominence is given to the natural sciences; nearly a year will be devoted to botany and horticulture, and a year and a half to chemical physics. Each student will devote two hours daily to analysis, under the direction of the professor of chemistry. Four courses of study have been provided, one in agriculture, one in civil engineering, one in mechanical engineering, and an elective course. The studies of the several courses are essentially the same for the first two years. Those marked E are elective.

ALL THE COURSES.—FIRST YEAR.—*First term.*—Physical geography, (Colton,) algebra, (Robinson,) rhetorical praxis, (Day.) *Second term.*—Physics, (Ganot,) algebra, (Robinson,) book-keeping, and commercial forms, botany, (Gray.) *Third term.*—Physics, (Ganot,) meteorology, geometry, (Loomis,) botany, (Gray, and Darlington,) horticulture. SECOND YEAR.—*First term.*—Chemistry, (Eliot and Storer,) geometry, (Loomis,) botany, (Johnson,) horticulture, elements of agriculture, (Waring.) *Second term.*—(E) Chemistry, (qualitative analysis,) (E) mineralogy, (Dana,) (E) history of France, trigonometry, mensuration, French, (Magill.) *Third term.*—(E) Chemistry, (qualitative analysis,) (E) history of England, surveying, (Gillespie,) navigation, French, (Magill.)

COURSE OF AGRICULTURE —THIRD YEAR.—*First term.*—Human and comparative anatomy and physiology, (Carpenter,) origin, preparation, and analysis of soils, fertilizers, ashes, &c., French, (Magill.) *Second term.*—Zoölogy, (Tenney,) farm implements, mechanical cultivation of the soil, farm drainage, (Waring.) (E) rhetoric, (Haven,) (E) German. *Third term.*—Mechanics, (Peck,) dairy farming, (Flint,) entomology, (Packard,) logic, German, English literature. FOURTH YEAR.—*First term.*—Geology, (Dana,) stock-breeding, (Goodale,) sheep husbandry, veterinary art, German, English literature, history of civilization. *Second term.*—Constitution of the United States, cultivation of cereals,

landscape gardening, rural architecture, mental and moral philosophy, international law. *Third term.*—Political economy, rural economy of England and the United States, rural law, mental and moral philosophy, international law.

COURSE IN CIVIL ENGINEERING—THIRD YEAR.—*First term.*—Human and comparative anatomy and physiology, (Carpenter,) analytical geometry, (Todhunter,) French, (Magill.) *Second term.*—Differential calculus, (Church,) descriptive geometry, (Watson,) free-hand drawing, mechanical drawing, engineering, rhetoric, (Haven,) German. *Third term.*—Integral calculus, (Church,) descriptive astronomy, mechanics, (Rankine,) drawing, logic, German, English literature. FOURTH YEAR.—*First term.*—Geology, practical astronomy, engineering, (Rankine,) descriptive geometry, (Watson,) drawing, German, English literature, history of civilization. *Second term.*—Constitution of the United States, engineering, (Rankine,) descriptive geometry, (Watson,) drawing, mental and moral philosophy, international law. *Third term.*—Political economy, engineering, (Rankine,) drawing, mental and moral philosophy, international law.

COURSE IN MECHANICAL ENGINEERING.—THE THIRD YEAR has the same course of study as the third year in civil engineering.—FOURTH YEAR.—*First term.*—Geology, (Dana,) practical astronomy, applied mechanics, (Rankine,) descriptive geometry, (Watson,) drawing, German, English literature, history of civilization. *Second term.*—Constitution of the United States, building materials, hand-machinery, (Rankine,) descriptive geometry, (Watson,) drawing, mental and moral philosophy, international law. *Third term.*—Political economy, steam-engines, (Rankine,) drawing, mental and moral philosophy, international law.

Experiments have been made on the farm to test the comparative value of cooked and uncooked food for feeding swine, and of several kinds of special manures for the growth of crops. Sixty-one varieties of the potato have been cultivated under different treatment of manuring, cutting and planting, and the results ascertained. There have been grown on the farm the present year, 40 tons of hay, 5 tons of fodder, 2 acres of corn-fodder, 627 bushels of potatoes, 96 of barley, 128 of English turnips, 100 of rutabaga, 83 of mangel-wurzel, a few bushels of beets and carrots, 50 tons of Hubbard and turban squashes, besides tomatoes and various summer vegetables furnished for the boarding-houses of the college. Forty sheep and eleven head of cattle have been sold, and 1,700 pounds of pork made during the year.

The labor system has been adopted, each student being required to labor not exceeding three hours a day for five days in the week, for which he is paid according to his faithfulness and industry, the maximum pay being 30 cents for three hours. Ten acres of the farm have been thoroughly underdrained by the students, under the direction of the professors, with parallel drains 40 feet apart. The farm superintendent says:

> The students, when assisting in the labors of the farm, have worked with diligence and cheerfulness. Their deportment has been uniformly respectful and kind. Their interest in the work assigned them and the faithful and zealous manner in which their tasks have been performed have rendered the oversight of their labor a real pleasure.

The whole number of students in attendance during the college year, ending in August, 1871, was 42.

MARYLAND.

The finances of Maryland Agricultural College, at Hyattsville, Rev. Samuel Regester, D. D., president, are in a sound and healthy condition.

In 1869 the college was embarrassed with a debt of $6,000, but such has been its success since that time that all this debt has been liquidated, and $7,569.73 have been received and expended in erecting additional buildings, repairing the college, fencing the farm, &c., making an outlay of $13,569.73, besides the ordinary college expenses, which have been promply paid as they became due. The total value of the college fund is $201,000. The number of students has been nearly doubled during the last two years, and the present session indicates still greater prosperity. They receive regular lessons in the theory and practice of agriculture and in military tactics, in addition to the regular course of study taught in the college.

The faculty remains the same as last year, with the exception of Douglas Williams, who has been elected professor of the natural sciences, including chemistry and its applications, geology, botany, and mineralogy, and N. B. Worthington, A. M., professor of agriculture, horticulture, pomology, &c.

The college farm of 283 acres is under tolerably good cultivation. A part is devoted to woodland, and the remainder, excepting the garden, is divided into seven fields of convenient size for tillage and pasture, all of which are inclosed with new and substantial fences. The crops of the farm this year were greatly diminished in consequence of severe drought. Twenty tons of hay, 135 bushels of oats, and 750 bushels of corn were raised. A herd of good cows furnished an ample supply of milk, and a considerable part of the butter used by the college. Thirty-one hogs were raised, which, after they were slaughtered, weighed 5,472 pounds, and cost 2⅓ cents per pound. This small cost of production is largely owing to carefully utilizing the waste from the kitchen and garden of the farm. The extensive and varied products of the garden and orchard are more than sufficient to meet the demands of the large college family. In consequence of this supply the officers of the college have been able to reduce the board of students considerably below the usual rate.

In speaking of the deportment of the students the president says:

It gives me great pleasure to state that the deportment of the students for kindly intercourse among themselves, respectful and deferential regard for those in authority over them, and cheerful compliance with the rules of the college is such as to command my highest admiration.

The expenses for tuition, matriculation fee, board, lights, fuel, washing, room-rent, use of furniture, text-books, &c., for the scholastic year, is $255. Students appointed by the State receive a deduction of tuition and use of books, amounting to $75. Number of students during the scholastic year ending in June, 1871, is 136.

MASSACHUSETTS.

The Massachusetts Agricultural College, at Amherst, William S. Clark, Ph. D., president, has been in operation about four years, during which the number of students has been constantly increasing, and the facilities for instruction enlarging. In 1868 there were 92 students in the college; during the present year there have been 166, 27 of whom have completed the four years' course and received diplomas. The legislature, at its last session, (1871,) appropriated $50,000 to the college for its immediate wants, and $100,000 to the permanent fund, in the care of the State, making the amount $350,000. This, at 6 per cent., affords an income of $21,000, two thirds of which are received by this college, and one-third by the Institute of Technology. The Hills fund of $10,000, given for the support of the botanic garden, yields at present an income

of $500, which, being added to the $14,000 from the permanent fund, makes the total income of the college from these sources $14,500. The real estate of the college, consisting of college buildings, conservatories, boarding-houses, farm, farm-buildings, and a quarry, is valued at $201,000; the stock on the farm at $9,255; vehicles and implements at $2,771. The credits of the farm during the year are $11,116.46, and the debits, $16,378.38. The State has appropriated, at different times, for the benefit of the college, $430,000, and this sum has been increased from other sources to $530,000. Miss Mary Robinson, of Medfield, during the present year, left a bequest of $2,000 for the purpose of establishing a scholarship, and several other persons have given smaller sums.

The Durfee plant-house contains about 1,000 species and varieties of plants, and the nursery a large number of fruit, flowering, and forest-trees and shrubs raised from seed or by budding. About 100 species of fodder-plants have been grown for experiment. One hundred and twenty-five tons of hay have been cut on 133 acres, the crop having been diminished at least one-third by drought. A considerable portion also of the mowing-land is run out and infested with ox-eye daisy, yellow dock, Canada thistle, and wild carrot. Forty-four thorough-bred cattle are kept on the farm, including Short-horn, Ayrshire, Jersey, Devon, Brittany, Swiss, and Dutch or Holstein. Five acres of the college farm have been cultivated with beets from imported seed of French and German varieties. The juice is found to be rich in saccharine matter. Professor Goessmann, the college chemist, obtained from the juice of the best Imperial and Electoral varieties over 8 per cent. of crystallized sugar with machinery not of the best quality. Sugar has been manufactured into all the desirable forms, as white coffee, granulated, and loaf, of the finest quality. Samples of brown sugar sent to Boston and New-York were pronounced of superior grade. With skillful cultivation one ton of sugar per acre may be obtained on the good tillage lands of Massachusetts. It is the opinion of Professor Goessmann that the production of beet-sugar may be made a profitable industry in Massachusetts, with as good results as in France or Germany.

The Massachusetts Institute of Technology, at Boston, John D. Runkle, Ph. D., LL. D., president, has been open for the reception of students about six years. The number of professors, assistant professors, and instructors is 34, and the number of students 264. This institution offers great and constantly increasing facilities for a thorough education in seven distinct courses of scientific and professional study. During the first two years the course is the same for all regular students, but at the beginning of the third year the student may take any one of the following courses: Civil, mechanical, or mining engineering, architecture, chemistry, science and literature, or natural history; each leading to the degree of bachelor of science in that course.

All the departments have been recently strengthened by a large increase in the teaching force, and in facilities for making the teaching practical. A new course in natural history has been prepared, and invaluable aid rendered by the Boston Society of Natural History, in opening its extensive and systematically arranged collections and library to the use of the students of the Institute. This wise and generous co-operation of the two institutions enables them at once to offer students in this department unsurpassed facilities. A laboratory of practical mining and metallurgy has also been established. This enables the student to treat the various ores in quantity, instead of confining him, as is usual, to assays of small amount. The mining laboratory already contains, in successful operation, the most approved ore-dressing and mill

machinery for treatment of gold and silver ores now in use in California and Nevada, consisting of a five-stamp battery, an amalgamating-pan, a separator, and a concentrator, complete in every respect, and capable of treating a half a ton of ore a day. There will be added during the coming vacation an ore-crusher, a dry pulverizer, a hydraulic jigger, a Ruttinger shaking-table, and all other appliances necessary for the treatment of every kind of ore. The machinery is driven by a steam-engine of about fifteen horse-power.

The metallurgical laboratory at present contains a reverberatory roasting-furnace, capable of roasting 50 to 75 pounds at a charge; crucible furnaces, assaying furnaces, a kettle, a blacksmith's forge, a Griffin's gas furnace, a screw-press, and a motor. The central portion of the floor of this laboratory will be removed, to gain about 5½ feet of additional height for the erection of reverberatory and blast smelting-furnaces, capable of working 400 pounds of ore per day, and a cupelling furnace sufficient for working 50 pounds of lead at once. To these will be added retort and smaller furnaces for various uses. Both of these laboratories will be completed and ready for use by October, 1872.

The various processes of ore-dressing, smelting, &c., are carried on and studied experimentally by the students, under the immediate supervision of an instructor, a sufficient quantity of ore being assigned to each student for his own work. The institute has now on hand about 11 tons of gold and silver ores, representing over seventy different mines in Colorado and Utah, which were collected by the institute party of professors and students during their recent trip to these Territories in the summer of the present year, (1871,) and additions will be received from time to time, as the wants of the laboratory require it. To further aid the students in their studies, and to familiarize them with the practical details of work, they are required to make occasional visits of inspection to machine-shops, engines, mills, mines, furnaces, and chemical works, and to important buildings and engineering constructions within convenient reach of the institute. During the present and the past year more than thirty places of this kind in Boston, Cambridge, Lowell, Lawrence, Nashua, Providence, and other towns have been often visited. Professors and students are allowed the full use of the Boston Public Library, which contains 200,000 volumes.

The institute receives an annual income of $4,232 from the national endowment fund, derived from the sale of the land-scrip. The regular tuition is $150 per year, $100 being required at the beginning and $50 at the middle of the school year. For one-half or any less fraction of the school year the tuition is $100.

MICHIGAN.

The State Agricultural College, at Lansing, T. C. Abbot, LL.D., president, has just completed a new laboratory containing all the latest improvements, including the Bonn self-ventilating evaporating hoods. It is fitted up with work-tables for 48 students in analytical chemistry, and can accommodate 75 in elementary chemistry. Rooms are provided for the use of students who wish to make researches in higher chemistry. The whole number of students for the college year ending in November, 1871, is 141, being an increase of 12 over the previous year. Of this number, 1 is a resident graduate, 12 are seniors, 9 juniors, 26 sophomores, 81 freshmen, 4 specials, and 8 ladies. There are now seven professors and one assistant professor, besides a foreman of the farm, with an assistant, and a foreman of the gardens. The junior class work the entire year under the direction of the professor of horticulture. The sopho-

mores spend the year under the direction of the professor of agriculture. The other classes alternate between the garden and farm. The lowest rates for labor do not exceed 2 or 3 cents per hour, if the student fails to render more valuable service. The highest price usually paid is 7½ cents per hour, but this year 12½ cents have been paid for work on Saturdays, if applied for by the foreman. Botany, chemistry, and animal physiology are studied from one to two years each. Entomology is illustrated by a valuable collection of native and exotic insects, and special attention is given to the study of species injurious to vegetation, and to the best modes of checking their ravages.

Several carefully conducted experiments have been made on the experimental farm in respect to the different modes and times of applying manures to crops, as by plowing in, spreading after plowing, applying in the spring or fall, with the results attending each; also, with different kinds of special manures or fertilizers, and the quantities of grain produced from each; with thirty-two popular varieties of the tomato, the number, weight, and marketable qualities of each being noted in tabulated form; and in fattening pure-bred pigs of the Essex, Suffolk, and Berkshire breeds, and grades of natives, showing the different fattening qualities of each breed, the quantity of meal usually necessary to produce a pound of pork, and the effect of the same quantity on younger and older animals.

A part of the land granted by Congress has been sold, amounting to $92,444. It is estimated that the fund of the college, when all the land is disposed of, will amount to about $707,000.

MINNESOTA.

The College of Agriculture and the Mechanic Arts of the University of Minnesota, at Minneapolis, William W. Folwell, A. M., president, received from the National Government 94,119 acres of land, which has been located in its own State. The number of acres to which it was entitled by the act of Congress of July 2, 1862, was 120,000, but in consequence of selecting lands above the minimum Government price it was reduced to the sums named above. Twenty-two thousand three hundred and ninety-four acres of this land have been sold for $128,265.74, of which sum $8,500 have been paid for the experimental farm, which contains 143 acres. The remainder of the money, $119,765.74, constitutes a permanent fund, from which an annual revenue of $7,557.27 is derived for the support of the college. For the payment of the expenses of the other departments of the university the regents rely chiefly upon the sales of timber from lands which have been appropriated by the State to the university as distinct from the national grant. The 71,725 acres of land now remaining unsold are increasing in value, and will not be disposed of until such a price can be obtained as will afford the college an ample fund for carrying out the plan of operations contemplated by the National Government and the State.

In June, 1870, the board of regents adopted a plan of re-organization, which involves in its ultimate scope a graded connection between all the public educational institutions in the State, ascending from the common school to the university. Under this plan the regents have as yet only organized—1. The Latin school; 2. The collegiate department; 3. The College of Science, Literature, and the Arts; 4. The College of Agriculture and the Mechanic Arts. For the last named a course of appropriate studies and exercises has been prescribed. The experimental farm has been provided with a sufficient supply of stock and implements, and a convenient barn has been built during the year. A

department of this college is devoted to the mechanic arts, as required by law, and a professor has been employed in it. The faculty of the university consists of the president, seven professors, and two assistants.

The chief want of the university is an enlargement of the present building. The class-rooms are overcrowded, and the demand for lodgings for students exceeds the supply. The receipts of the university for the present year, including $11,880.74 in the treasury at its commencement, amount to $28,875.61, and the current expenses were $22,500. Congress, on the 8th day of July, 1870, made a grant of seventy-two sections of land, to be located by the governor of the State, for the benefit of the university.

The number of students during the year ending December 1, 1870, was 301. Of these, 53 males and 22 females were in the scientific department, and 61 males and 21 females in the classical department. Ninety-one of the students in the university were ladies.

MISSISSIPPI.

This State accepted the congressional grant of land-scrip, October 30, 1866, and received 210,000 acres. By an act of the legislature in 1871, two-fifths (84,000 acres) of this land were given to the University of Mississippi, and the remaining three-fifths (126,000 acres) to the Alcorn University, for the purpose of establishing an industrial college in each of those institutions.

The University of Mississippi, Rev. John N. Waddel, D. D., chancellor, is located at Oxford, in La Fayette County. The board of trustees of the university, in June, 1871, directed that the congressional land-scrip should be sold by the governor of the State and invested in State bonds. A committee was appointed to take into consideration the best way of expending the income of the funds. At a subsequent meeting a report was made by the committee, and adopted by the board of trustees, recommending the organization of a college of agriculture and the mechanic arts in connection with the university, as soon as the funds could be rendered available, the establishment of professorships in agricultural chemistry, botany, and zoölogy, practical agriculture, civil engineering, technology, and the mechanic arts, and the appointment of the superintendent of the farm.

Mr. E. W. Hilgard has been appointed professor of experimental and agricultural chemistry, and is now delivering, (December 1871,) during the current session of the university, a course of lectures on agricultural and technical chemistry, which are attended by the students from other regular courses in the university as a collateral study, since no students in agriculture and the mechanic arts can, at present, be received. It is hoped, however, that before the next scholastic year everything will be in readiness to put the college into full operation. A farm of 20 acres will be provided and used to illustrate the teachings of the professors practically, and on which the students will be encouraged to labor, but no compulsory requirement will be made. Students from the State will be admitted free of tuition.

Nothing has been learned in regard to Alcorn University, except that it has been located near the village of Rodney, Jefferson County, in connection with Oakland College, which has been purchased for the sum of $30,000.

MISSOURI.

The Agricultural and Mechanical College of Missouri, Daniel Read, LL. D., president, was located at Columbia, May 3, 1870. It is a department of the University of Missouri, and under the immediate care

of Professor G. C. Swallow, but will occupy another building which the curators are now erecting. This edifice will contain extensive laboratories for chemistry, physics, and mechanics, lecture-rooms, and extensive cabinets of rocks, minerals, soils, and objects of natural history. The professor of agriculture was elected in September, 1870, and the first class formed on the 17th of the same month. The number of students in the class of the first collegiate year ending in June, 1871, was 29, and 35 have entered the second or freshman class for the next year. The students recite in the university in the branches of the agricultural course, under the instruction of the professor of agriculture and the other professors, and are admitted to all their lectures and to the library. Congress gave 330,000 acres of land for the endowment of an industrial college, three-fourths of which, 247,500 acres, the legislature appropriated for the Agricultural and Mechanical College, and one-fourth, 82,500 acres, for the School of Mines and Metallurgy, located at Rolla, which is also a department of the University. None of this land has been sold, and the college has been obliged to depend, thus far, upon the income derived from the rent of the congressional land-grant and the liberality of private parties to defray the expenses incurred in conducting it. The university has seven professors and five teachers. The library contains 4,000 volumes, and the cabinet of minerals 500,000 specimens, to which the students of all the departments are admitted.

It is the design of this college to give its students such an education as will fit them for intellectual and manual labor, that they may thus be prepared to honor labor and utilize and dignify learning. Several students are now paying all their college expenses by labor. There are three courses of study: An agricultural course of three years, a resident graduate course of one year, and a horticultural course of one year, the latter designed for young men and young women who wish to fit themselves for the highest success in the culture of fruit and flowers, and in the ornamentation of lawns and pleasure-grounds.

The agricultural course embraces horticultural botany, vegetable chemistry, essays on pruning, transplanting, and propagation; meteorology, climatology, soils, tillage, draining, kitchen garden, hot-beds; experiments in producing new varieties of plants, natural history, botany, geometry, English literature, rhetoric; experimental culture of fruits, anatomy and physiology of domestic animals, animal chemistry, trigonometry, physics and chemistry, with laboratory practice; essays on plants, agricultural chemistry, fertilizers, entomology, water-supplies, orchards, nurseries, vineyards; essays on soils and fertilizers, human anatomy and physiology, forestry, influence of trees on climate and soil, experimental culture of forest-trees, agricultural architecture, farm buildings, veterinary surgery and medicine; essays on forestry, mechanics, mental philosophy, mineralogy, landscape gardening, botanic garden, greenhouses, propagation and culture of ornamental plants; essays on landscape gardening, geology, and paleontology. Latin, German, French, analytical geometry, calculus, evidences of Christianity, and natural theology are optional. The resident-graduate course embraces a few additional studies.

The farm has been in possession of the college only about a year, during which time the buildings which were upon it have been repaired, and new ones built, ponds and cisterns made, stumps removed, and grounds in general put in condition to commence experimental cultivation at an early date. A few domestic animals of good quality have been purchased, and a good assortment of agricultural implements collected. Two vineyards have been planted, containing several thousand

vines in each, and an experimental vineyard containing three hundred vines and over fifty varieties.

The agricultural and mechanical college farm and buildings are valued at $60,000; the university buildings at $170,000; and the apparatus and library at $30,000.

NEBRASKA.

The University of Nebraska, at Lincoln, was opened for the reception of students on the 7th of September, 1871. The different colleges of this university were named in the report of the Department for 1870. Three courses of study, each occupying four years, have so far been adopted: a classical course, a scientific course, and a select course. The faculty consists of Allen R. Benton, LL. D., chancellor, and professor of intellectual and moral science; S. H. Manly, A. M., professor of ancient languages and literature; O. C. Drake, A. M., professor of rhetoric and English literature; Samuel Aughey, A. M., professor of chemistry and natural sciences; George E. Church, A. M., principal of the Latin school. The chair of mathematics has not yet been filled, but a professor will be elected at an early date. Other professors will be provided as soon as the wants of the university require it. The agricultural college of the university has not yet been opened, but it will be as soon as is practicable, probably at the beginning of the next college year.

The university has received two grants of land-scrip from Congress; one of 90,000 acres, under the act of July 2, 1862, for the purpose of endowing a college for the benefit of agriculture and the mechanic arts; and another, of 44,800 acres, by an act of Congress, approved April 19, 1864, for the use and support of a State university. The sum of these grants is 134,800 acres. The university building is a fine edifice, one hundred and sixty-five feet in length, and contains forty-eight rooms, all of which are designed for purposes of instruction. The board of regents have made liberal appropriations for the purchase of philosophical and chemical apparatus, library, maps, and charts, and for the arrangement of the cabinet and museum. The university grounds embrace twelve acres. The buildings are valued at $152,000, and the apparatus and library at $7,000.

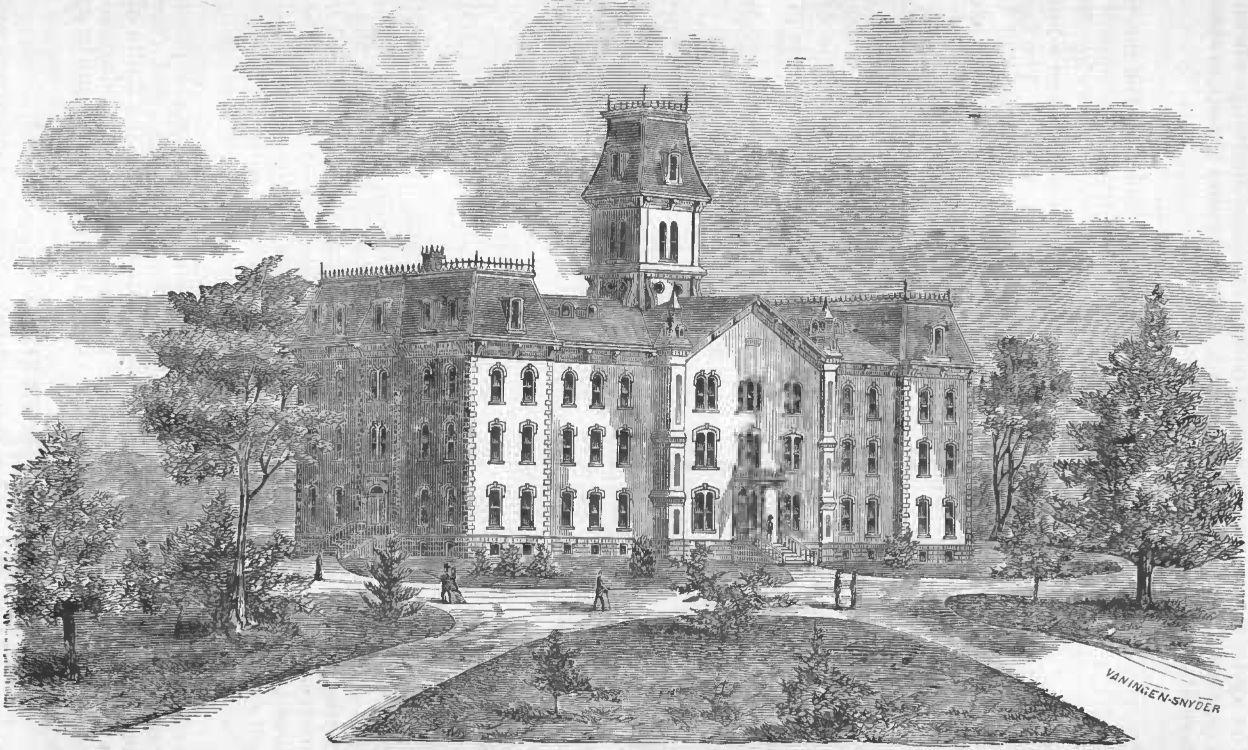
The scholastic year is divided into three terms, with three vacations. The first term commences on the first Thursday in September; the second on the first Thursday in January; and the third on the first Thursday in April. The university has no dormitory system, but board is provided by families at a reasonable rate. It may now be obtained at four to five dollars per week, and by renting a room and taking meals out, it can be furnished for about three dollars and fifty cents.

NEVADA.

Nevada accepted the congressional grant for the establishment of agricultural and mechanical colleges February 13, 1867, and received 90,000 acres in land, which has been located within the limits of the State. None of the land has yet been sold, nor has any industrial college been established, but it is expected that one will be put in operation in a year or two.

NEW HAMPSHIRE.

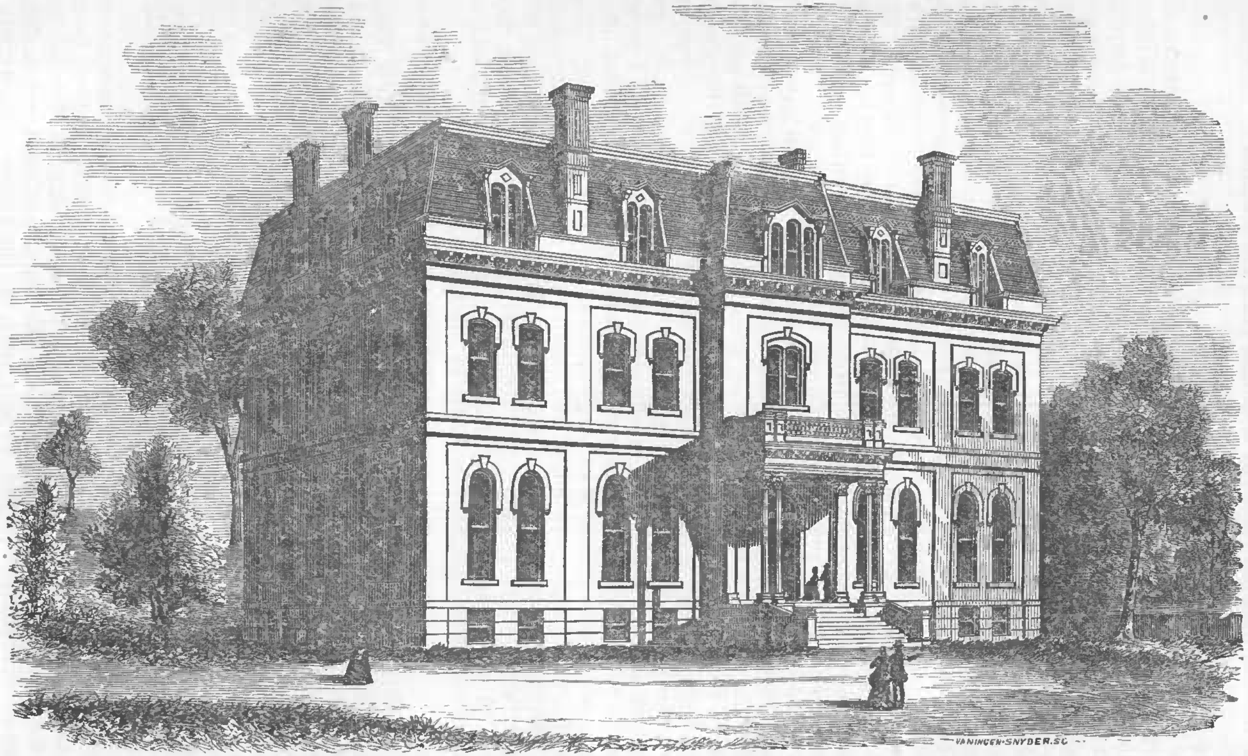
A full account of the New Hampshire College of Agriculture and the Mechanic Arts, at Hanover, Rev. Asa D. Smith, D. D., LL. D., president, was given in the report of the Department for 1870. As but little information has been received from the institution during the present year, we are unable to give any extended detail of its progress. It has



UNIVERSITY OF NEBRASKA (COLLEGE OF AGRICULTURE), LINCOLN, NEBRASKA.

PLATE XXV.

PLATE XXVI.



CULVER HALL (NEW HAMPSHIRE COLLEGE OF AGRICULTURE), HANOVER, N. H.

two professors, eight instructors, and twelve students who are pursuing the regular course of study in agriculture and the mechanic arts. The annual income derived from the national endowment fund is $4,800.

NEW JERSEY.

The steady increase in the number of professors and students in the scientific school of Rutgers College, at New Brunswick, Rev. William H. Campbell, D. D., president, has rendered it necessary to provide additional buildings. The trustees are, therefore, now erecting a geological hall, a fine stone building, which will contain rooms for a geological museum for recitations, for military drill, and for the general use of the scientific and agricultural departments. It is the intention of the trustees to complete this building before the end of the present academical year, in June, 1872. There are ten professors connected with the school. The number of students for the academic year ending in June, 1871, is sixty-eight, being an increase of twenty-two over the last year. Two of this number are from the Empire of Japan. The school has a permanent fund of $116,000, derived from the land-scrip, and has received in addition $8,000 from private individuals. The annual revenue derived from the permanent fund is $6,960.

The course of study in this school is thorough, and practical agriculture is made a specialty. The experimental farm contains 99 acres, and is under the care of the professor of chemistry and agriculture, Dr. George H. Cook, whose extensive knowledge of geology and European farming eminently fit him for such a position. The students labor regularly on this land. Twenty acres of the farm, near the college buildings, are kept in grass, or used for garden, soiling, or root crops. The remainder is to be kept in Indian corn, potatoes, oats, wheat, clover, and timothy; not leaving any pasture, woodland, or waste ground. The details of kind and preparation of soil, manuring, modes of culture, &c., are given in the annual report for 1871. There are on the farm six cows and six heifers of the Ayrshire breed, two Durhams, and five natives. A tabulated statement is given of the average daily yield of milk from each cow, the yield per month, and for the year.

NEW YORK.

The national land-grant which was given by the State of New York to the Cornell University at Ithaca, Andrew D. White, LL. D., president, was designed especially to support two of the nine colleges of the university, namely, the College of Agriculture and the College of the Mechanic Arts. The university, however, is required by the act of incorporation to educate, free of expense for instruction, one student from each of the one hundred and twenty-eight assembly districts of the State, for a period of four years, in any of the colleges which he may choose to elect. These students are selected by competitive examinations from the various public schools and academies of the State of New York.

The trustees are making special efforts to extend the operations of the Colleges of Agriculture and the Mechanic Arts, and the income from the sales of the lands of the congressional grant will be applied to this object as fast as they are sold. A large building, costing $40,000, has been completed during the current year, for the special accommodation of the College of the Mechanic Arts. It is built of stone, and is the gift of Mr. Hiram Sibley, of Rochester. Another edifice, 250 feet by 60 feet, called the McGraw building, has also been completed during this year, and is to be occupied by the museums and library. It is built

at an expense of $150,000, by Mr. John McGraw, of Ithaca, and is composed of dark-blue stone, with dressings and corners of Onondaga gray limestone. The main central portion of the building comprises one hall, which is 100 feet long, 56 wide, and 19 high. There is also another room above this of the same length and breadth, but 30 feet in height. Miss Jennie McGraw, of Ithaca, has given the university a set of chime-bells, nine in number, which cost several thousand dollars. Valuable gifts of stock have been made by Lewis Morris, esq., of Fordham, and Mr. Allen B. Benham, director of the college farm. There are 8 professors and 20 students in the College of Agriculture, 4 professors and 20 students in the College of the Mechanic Arts, and 39 professors and assistant professors and 595 students in all the colleges of the university. As the university increases in age, the classes in agriculture are becoming larger in proportion to those in other branches. The farm has been steadily improved, but no experiments have been made, and no special system of labor has yet been adopted. Several students work on the farm for the purpose of earning money to defray a portion of their expenses; several garden-plats have been let out to others to cultivate on shares, and a prize has been awarded for the garden that is best managed. The sum paid to students since 1868, for manual and other labor, has exceeded $30,000. The gifts to the university during the present year, in the shape of buildings, books, apparatus, and money, have amounted to about $300,000. The university has sold 465,000 of the 990,000 acres of land-scrip, received from Congress, for $428,350. The total amount of the university fund, exclusive of land unsold, is $1,101,998. The annual revenue derived from this fund is $64,917; the value of the university buildings, $500,000, and of the library and apparatus, $150,000.

NORTH CAROLINA.

North Carolina accepted the congressional grant February 24, 1866, and received 270,000 acres in scrip. By an act of the general assembly of the State, approved February 11, 1867, the scrip was transferred to the trustees of the University of North Carolina, at Chapel Hill, who, in the language of the act, were—

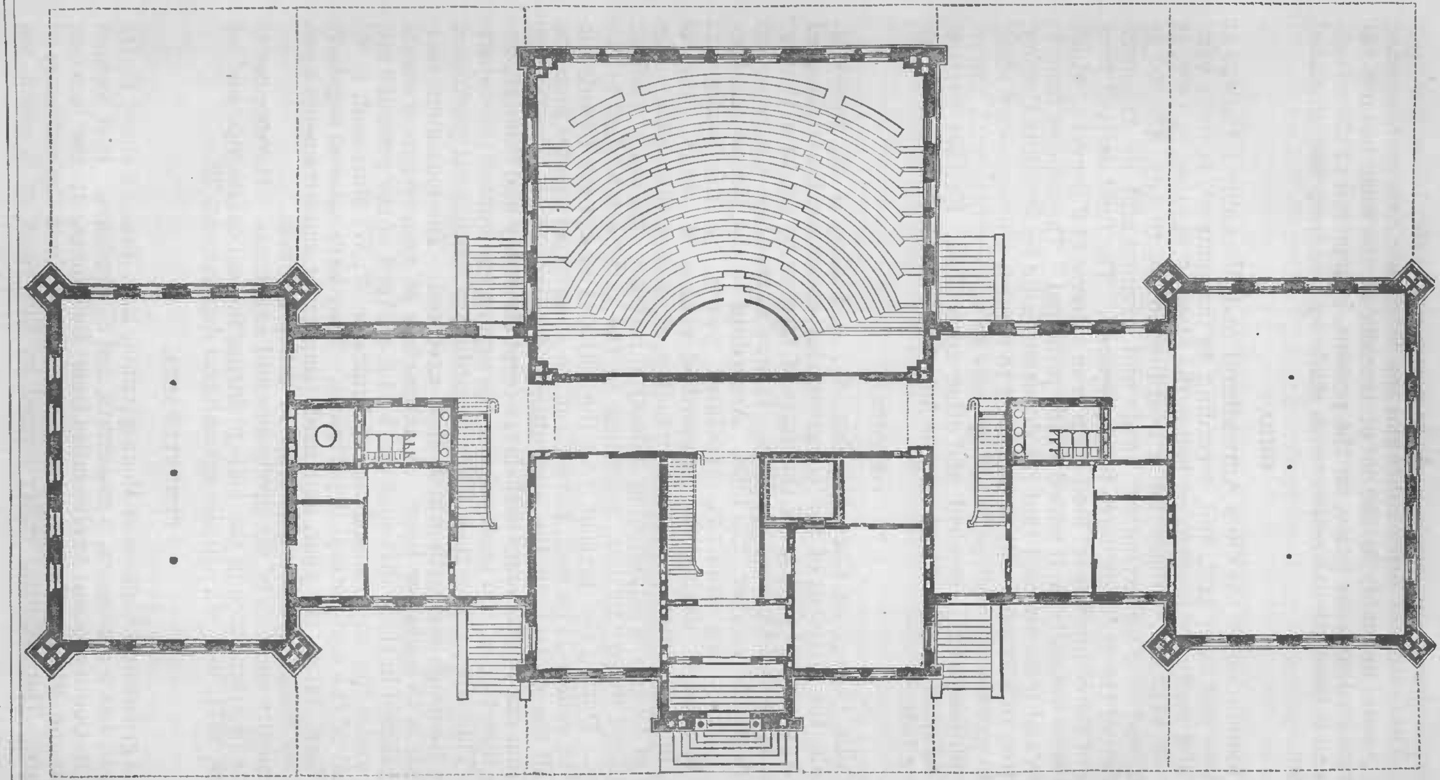
> Instructed to dispose of the same as they may think best, and with the proceeds to establish, in addition to the course of instruction prescribed in the regular curriculum of the university, two professorships, in which the leading object shall be, without excluding other scientific and classical studies and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the general assembly may prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life.

The act also provides that—

> It shall be the privilege of the county court in each county of the State forever to select annually one native of the State, resident in said county, of good moral character and capacity for usefulness, without the requisite means to defray the necessary expenses of education, who shall be admitted to any class in the university for which he may be prepared, free from all charge for tuition and room-rent, so that each county may always have one representative at the institution.

In the winter of 1867 and 1868 the trustees sold the scrip for $135,000, and at the time of the sale received the sum of $10,000 or $12,000 in cash, which was used for purposes connected with the university. Under the constitution of the State, adopted in 1868, a new board of trustees was elected, and in July, 1869, they received the balance of the money for which the land-scrip had been sold. During the winter of the following year they invested it in North Carolina bonds, most of

PLATE XXVII.



GROUND PLAN OF OHIO AGRICULTURAL AND MECHANICAL COLLEGE.

which were special-tax bonds, and are now considerably below their par value. The College of Agriculture and the Mechanic Arts contemplated by the general assembly in the act of transfer of the scrip has not yet been organized, and the State, for the present, is deprived of the advantages which the national endowment made by Congress was intended to confer.

OHIO.

The foundation of the Ohio Agricultural and Mechanical College at Columbus has been laid, and, according to the contract, is to be completed and ready for occupation before the close of autumn, in 1872, at a cost of $112,480. Plans for a boarding-house, to cost $30,000 to $40,000, and also for laying out roads and avenues and for the ornamentation of the grounds, have been prepared. The fund derived from the sale of the congressional land-scrip is on interest at 6 per cent., which is paid semi annually, and added to the principal. The college farm is paid for, and it is expected that the donation made by Franklin County, amounting to $300,000, will be sufficient to furnish the necessary stock for it, to pay for the college buildings, and to supply them with the required philosophical, chemical, and other apparatus. Further particulars in relation to this college may be found in the report of the Department for 1870.

OREGON.

Corvallis College at Corvallis, Rev. W. A. Finley, D. D., president. was made the recipient of the congressional endowment, and adopted as the Agricultural College of the State of Oregon by an act of the legislature, approved October 27, 1868. It was opened for the reception of students November 22, 1868. According to the law of incorporation, twenty-two students, appointed yearly by the State, are to be instructed during the prescribed course of study, free of tuition, in agriculture and other branches of science contemplated by the act of Congress establishing industrial colleges. All other students are required to pay tuition, according to the rates established by the trustees. During the present year the citizens of Benton County, in which the college is located, have given to it an experimental farm, on which all the students in the agricultural department are required to labor from one to two hours each day, except Saturday and Sunday, under the direction of the professors or the superintendents of the department. They are paid for their labor according to the amount performed and the thoroughness with which it is executed. The maximum compensation is 15 cents per hour. A labor-class of twenty-two students was organized in three divisions on the 1st of April of the present year, (1871,) under the superintendence of Professor W. W. Moreland, B. S., principal of the agricultural department. They have labored regularly on the farm during the year, and made important improvements upon it, besides raising considerable crops of different kinds.

The faculty consists of six professors and assistants. The number of students in attendance in the college during the collegiate year ending June 29, 1871, was 143; in the agricultural department, 22.

PENNSYLVANIA.

The Agricultural College of Pennsylvania, Rev. James Calder, D. D., president, has 8 professors, 8 assistants, and 87 students. It is located in Centre County, about twelve miles from Bellefonte, at the junction of Penn and Nittany Valleys, nearly equi-distant from the extremes of the State. The beautiful valley formed by this junction is about ten

miles wide, and, like the other two, is a fine farming region in a very high state of cultivation. It extends from the college to the Juniata River and Pennsylvania Railroad, a distance of twenty miles. A railroad is now being constructed, and will soon be completed, from Lewisburgh, in Union County, to Tyrone, which will pass within a mile or two of the college, thus affording easy access to it from all parts of the State.

There are three model and experimental farms belonging to the college, which are under the general supervision of the professor of agriculture. The central, in Centre County, containing 400 acres, one-half of which was given to the college by General James Irvin, then valued at $12,000, and the remainder was purchased by the trustees for $12,000; the eastern, in Chester County, containing 100 acres, and costing $17,000; and the western, in Indiana County, containing 121 acres, and costing $18,136.50. Only 100 acres of the central farm are cultivated as a model and experimental farm. Of the remaining 300 acres, usually called the college farm, about one-half is cultivated, partly by hired labor and partly by the students, for experimental purposes, and to illustrate the branches taught in the college. The remainder is occupied by the college buildings and grounds, the garden, orchard, and two pieces of woodland. The model and experimental farms are cultivated entirely by hired labor, under the direction of a superintendent, who reports the results of his experiments to the professor of agriculture. Twenty-five acres of each farm are especially devoted to experiments, and the remainder to model farming. The law of the State requires that these farms shall be conducted as models for imitation by farmers in successful practical agriculture, and as experimental farms on which to decide, by actual results, those doubtful questions as to modes of culture, relative value of manures, kinds of seeds, succession of crops, qualities of live-stock, &c., which so often perplex the farmer. Ten thousand dollars have been recently expended by public-spirited citizens in the vicinity of these farms in stocking them with choice breeds of domestic animals, which consist of Durham, imported Alderney, and Holstein bulls, one pure and several grade Durham cows, and a number of breeding swine of the Chester County breed. Numerous experiments with different crops have been made on these farms during the present year.

The part of the central farm on which the students work is cultivated in five sections of nearly equal size. They labor ten hours each week, the work being rendered in details of four hours, either in the forenoon or afternoon, on alternate days, except Saturdays, when both labor and recitations are suspended. This arrangement affords them an opportunity to put in practice the theoretical knowledge of husbandry which they have learned in the recitation-room, and to study those processes of cultivation from which the best results are obtained. The most improved implements are used, and their construction and operation explained. The professor of agriculture says that he has never had more nor better work done in the same time than by the students of the agricultural college during the term just closed. With a working force never exceeding eight lads in detail at once, and the working time only eight hours each day for five days in the week, and with a draught force of only nine light mules, the arable portion of the farm, including the garden, has been as well, promptly, and productively cultivated as any farm in the State.

There is a mechanical department in charge of a skillful and experienced master-mechanic, with proper blacksmith and carpenter shops,

and other appliances for repairs of the buildings and fixtures, and of the farming implements, and for the manufacture of such new articles for use as may be constructed on the place. In this work he is assisted, when necessary and desirable for the purposes of instruction, by students during their regular work-hours.

In addition to the national endowment, amounting to $439,186.80, the college has received from the State $99,900; from citizens of Centre, Clinton, Blair, Mifflin, Allegheny, Dauphin, Erie, and other counties, $52,000; from General James Irvin, in land for farm, $12,000; and from Mr. Elliott Cresson, $5,000; making a total from all sources of $608,086.80. The college buildings cost $200,000, the library $3,500, the chemical and philosophical apparatus $3,068, and the mineralogical cabinet, exclusive of the Rogers geological collection, $650. One-tenth of the national endowment was expended in purchasing the farms, leaving an available fund of $395,300.30, which yields an annual income of about $24,000.

RHODE ISLAND.

The congressional land-scrip was assigned by the legislature of the State to Brown University, at Providence, Rev. Alexis Caswell, D. D., LL.D., president, on the condition that it should provide a course of instruction adapted to the wants of students in agriculture and the mechanic arts; that the State should nominate beneficiaries to receive the benefit of the interest on the fund ($50,000) derived from the sale of the land-scrip; that the university should educate one beneficiary one year for every $100 income from the fund; and that such beneficiary should have the option of pursuing the regular classical course without reference to special studies in agriculture and the mechanic arts. In accordance with this agreement, some ten or twelve nominations have been made since the opening of the agricultural and scientific department in 1868. These beneficiaries have generally selected the regular classical course instead of the agricultural. On consideration of the operation of this arrangement, doubts have arisen in the minds of some members of the legislature whether this is the proper method of carrying out the law of Congress, and therefore no appointments have been made for the last collegiate year ending in June, 1871. The matter now remains in the hands of a committee of the legislature, and the expectation is that it will make a report at the next session, in January, 1872. The number of beneficiaries receiving education from the interest of the fund is seven. The balance of interest on the fund now unappropriated and remaining in the hands of the treasurer of the university is $1,957.37, a sum sufficient for the education of nineteen beneficiaries for one year, who might now be appointed by the legislature, if thought desirable.

The course of study pursued in the agricultural and scientific department was given in the report of the Department for 1868. The faculty consists of Rev. Alexis Caswell, D. D., LL.D., president; George I. Chace, LL.D, professor of general and applied chemistry; Samuel S. Greene, LL.D., professor of natural philosophy and astronomy; Rev. J. Lewis Diman, D. D., professor of political economy; Benjamin F. Clarke, A. M., professor of mathematics and engineering; John H. Appleton, A. M., professor of chemistry applied to the arts; T. Whiting Bancroft, A. M., professor of rhetoric and English literature; Theodore M. Hobingand, instructor in French.

The college year commences near the 1st of September, and is divided into two terms, with a winter vacation of three weeks and a summer vacation of nine weeks. Board from $3.25 to $5 per week.

SOUTH CAROLINA.

This State accepted the congressional grant of land-scrip December 10, 1868, and received 180,000 acres. The scrip was sold for $130,500, and on the 12th of March, 1872, the legislature established the South Carolina Agricultural College and Mechanics' Institute, at Orangeburg, in connection with the Claflin University. A board of trustees has been organized, and the college will be opened as soon as possible.

TENNESSEE.

In January, 1869, the general assembly appropriated to East Tennessee University, at Knoxville, Rev. Thomas W. Humes, S. T. D., president, the proceeds of the sale of the land-scrip which the United States, by the act of July 2, 1862, gave to Tennessee for the work of industrial education in that State. The conditions of this appropriation were accepted by the trustees, and in June, 1869, the Tennessee Agricultural College was organized, according to the provisions of the congressional act, as a branch of the university, and has been in operation about two years. It is designed to make it a leading department of the university, in which students may acquire a knowledge of the latest discoveries in the sciences and arts, and of their most successful application to the business of farming; also to combine instruction in both the theory and practice of agriculture and horticulture. A beautiful farm of 300 acres has been provided, upon which experiments with different crops will be made, and the students instructed in the operations which they perform in the field. The courses of study are as follows:

Agricultural course—Freshman year.—First session: Algebra, (beginning at equations of the second degree,) composition, natural history of domestic animals, universal history. *Second session:* Geometry, (beginning at the third book,) physical geography, chemical physics, universal history. Lectures on agriculture, with practical instruction, and also instruction in elocution throughout the year. *Sophomore year.—First session:* Plane and spherical trigonometry, mensuration, surveying, navigation, analytical geometry commenced, manual of agriculture, zoölogy, general chemistry, history of English language, French. *Second session:* Analytical geometry completed, calculus, elementary geology, botany, French, lectures on agriculture, with practical instruction. English composition and elocution throughout the year. *Junior year.—First session:* Physics, agricultural chemistry, logic, botany completed. *Second session:* Optics, astronomy commenced, agricultural chemistry, farm implements and drainage. Whately's Rhetoric. English composition throughout the year. *Senior year.—First session:* Astronomy completed, meteorology, German, special instruction in agricultural science, with experiments. *Second session:* Geology and mineralogy, political economy, Constitution of the United States, English literature, evidences of Christianity, special instruction in agriculture and horticulture.

Mechanical course—Freshman year.—First session: Algebra, (beginning at equations of second degree,) composition, drawing, lectures on mechanics, universal history. *Second session:* Geometry, (beginning at third book,) physical geography, chemical physics, lectures on mechanics, universal history. Instruction in elocution throughout the year. *Sophomore year.—First session:* Plane and spherical trigonometry, mensuration, surveying, navigation, analytical geometry commenced, drawing, building materials, general chemistry, zoölogy, history of English language, French. *Second session:* Analytical geometry completed, curves, calculus, elementary geology, plans and specifications, French.

lectures on mechanics, visits to and reports on shops, mines, and factories. English composition and elocution throughout the year. *Junior year.—First session:* Physics, applications of the calculus, rhetoric, shades and shadows, isometrical drawing. *Second session:* Optics, astronomy commenced, logic, topographical drawing. *Senior year.—First session:* Astronomy completed, meteorology, German, civil engineering. *Second session:* Geology and mineralogy, political economy, Story's Constitution of the United States, evidences of Christianity, English literature, civil engineering.

Two shorter courses, each occupying two years, have been arranged for students whose advanced age or pecuniary means will not permit them to pursue the longer ones—one for agricultural students and the other for students in the mechanic arts, but no diplomas are given to those taking the shorter courses.

The college year is divided into two terms of twenty weeks each. The winter term begins the third Thursday in September; the summer term on the day after the close of the winter term. Tuition is free to three students for each county of the State, who are nominated to the college by the county representatives in the legislature. To other students it is $18 per term. Board is $2 per week.

The number of students in the university for the scholastic year ending in June, 1871, was 115; in the agricultural and mechanical courses, 40.

TEXAS.

This State accepted the congressional grant November 1, 1866, receiving 180,000 acres in scrip. By an act approved April 17, 1871, the legislature incorporated the "Agricultural and Mechanical College of Texas," and located it at Bryan, in Brazos County. The proceeds of the national endowment, amounting to $156,600, have been invested in "frontier-defense" bonds of the State, bearing 7 per cent. interest, payable in gold. The annual income derived from this fund is $10,962. The sum of $18,000 has been expended in erecting buildings, under the direction of the board of commissioners, which consists of John G. Bell, J. W. Johnson, and Livingston Lindsay. They will be completed as soon as practicable.

VERMONT.

A pretty full account was given of the University of Vermont and State Agricultural College, at Burlington, Matthew H. Buckham, A. M., president, in the report of the Department for 1870. Some changes have been made during the present year, which are worthy of record. By a recent vote of the trustees, young women are to be admitted to the academic and scientific departments of the institution, on the same conditions as young men, at the beginning of the spring term of 1872. The academic year has also been divided into three terms of thirteen weeks each, with a vacation of two weeks from Wednesday before Christmas, of one week from the close of the spring term, and of ten weeks from commencement day, which will hereafter be on the second Wednesday in July. For the present year the winter vacation will continue five weeks from the last Wednesday in November. Twelve scholarships from the Washburn fund, and three otherwise endowed, are available for the assistance of deserving young men, to the amount of their tuition. Appointments are made to these scholarships from term to term. From the thoroughness of its course of study in the agricultural and scientific department, this institution is giving its students an excellent training in theoretical and scientific agriculture, but as it

has no organized system of labor nor experimental farm, we are unable to report any progress in practical farming or horticulture. The whole number of students in attendance at the university and college during the academic year, ending in July, 1871, is 126, being an increase of 11 students over that of last year. Of these, 23 attended the agricultural and scientific department.

VIRGINIA.

This State accepted the congressional grant of land-scrip February 5, 1864, the amount appropriated being 300,000 acres. The scrip was sold for $285,000, and the legislature, by an act approved March 19, 1872, established two industrial institutions, one called the Virginia Agricultural and Mechanical College, at Blacksburg, in the county of Montgomery, and the other the Hampton Normal and Agricultural Institute, at Hampton, in the county of Elizabeth City. Two-thirds of the proceeds of the congressional grant have been appropriated to the former institution and one-third to the latter. A board of directors, of which Dr. Harvey Black is rector, has been organized for the Virginia Agricultural and Mechanical College, and both institutions will be opened for the reception of students at the earliest opportunity.

WEST VIRGINIA.

The West Virginia University, at Morgantown, Rev. Alexander Martin, D. D., president, has been established only about four years, during which time commodious buildings have been erected, and a fund collected sufficient to place it on a firm foundation. Besides the funds received from the sale of the congressional lands, from the contribution of citizens of Morgantown, and from the Peabody educational fund, the legislature of the State now appropriates $10,000 annually toward the permanent endowment fund, with the addition of a sufficient sum to meet the annual deficit incurred in the necessary expenses of conducting the university.

The regents have offered a prize of $25 to the student who shall write the best essay upon a given subject, and another of $15 to the one who shall be adjudged the best declaimer. General G. W. Brown has also given an annual revenue of $100, to be awarded to the students of the literary societies for superiority in essay writing, oratory, declamation, and debate. The university supports 7 professors and 3 teachers. There has been a healthy increase of students in attendance over the previous year, the number for the year ending in June, 1871, being in all the departments 171. Of these, 69 are in the literary, scientific, engineering, and agricultural departments; the remainder in the preparatory department. The course of study in the agricultural department occupies three years. There is a small farm connected with the university; but the labor system is voluntary, and the work thus far done has been principally devoted to improving and ornamenting the university grounds. The students are drilled in military tactics one hour on Monday, Tuesday, and Wednesday afternoons.

The university buildings are valued at $80,000, and the apparatus and library at $5,000.

WISCONSIN.

The University of Wisconsin, at Madison, Rev. J. H. Twombly, D. D., president, is in complete working order. The chair of military science and engineering, which was vacant when our report for 1870 was made,

is now filled by Major W. J. L. Nicodemus, a graduate of West Point. The university employs in the different departments fifteen professors and seven teachers. The whole number of students in attendance during the year ending in June, 1871, is 485. Of this number 55 were in the college of arts, and 124 in the female college. The classes in the several departments are represented as above the average of former years in scholarship.

The legislature of 1870 appropriated $50,000 for building a female college, and the regents of the university have erected a fine stone edifice 50 feet by 75 feet, with a wing 40 feet by 87 feet, both three stories high, besides the basement. It is provided with portico, piazzas, ample halls and recitation-rooms, closets, furnaces, laundry, cooking-range, and a full supply of water distributed throughout the building. The basement is arranged for domestic uses. There is a sufficient number of rooms to accommodate about eighty ladies, besides rooms for music, painting, and drawing, and for the female teachers. The arrangements are such that young women may be educated entirely in the female college under lady teachers, or they may join the regular classes in the university, just as they think would be most for their advantage. The whole expense per year for a lady attending this college will not exceed $170. Important additions have been made to the apparatus for illustrating chemistry and other natural sciences. The university library contains nearly 4,000 volumes, to which all the students have access without charge. The university has no special want at present, except a building for a chapel and public hall, and an increase of the library, for which it is expected by the regents that the legislature will make an appropriation at an early date.

The professor of agriculture, W. W. Daniells, has made carefully conducted experiments on the farm with two varieties of winter wheat, to test the feasibility of cultivating it in Wisconsin; with six plats of spring wheat, to test the results of thin and thick seeding; with two plats of spring wheat, to test the comparative yield when sown broadcast and when drilled; with eight varieties of oats, sown broadcast, to find their comparative yield; with four plats of barley, of the same variety, to ascertain the different yield of thin and thick sowing; with three varieties of barley; with five of Indian corn; with equal quantities of the same variety of corn, planted at different distances, and with twenty-six varieties of the potato, for the purpose of testing the comparative yield. The average yield of different crops on the university farm for the year 1871 is as follows: Winter wheat, 22½ bushels; spring wheat, 22 bushels; oats, $50\frac{9}{10}$ bushels; corn, 53 bushels; barley, 47⅓ bushels; navy beans, $17\frac{2}{5}$ bushels; potatoes, 148 bushels. Extensive meteorological observations have been made daily at the university, according to the plan adopted by the Smithsonian Institution, and recorded in a tabulated form. Additional particulars in relation to this university may be found in the reports for 1867, '68, '69, '70.

The statistics contained in the following table, except the last column, relate expressly to the agricultural and mechanical colleges, and the endowment received by them from the United States. It has been prepared with much care, and submitted to the president of each college for a final revision, in order that it might be reliable as a table for reference.

Statistics, for 1871, of the industrial institutions in the United States which

	Location.		Name of the institution.
	State.	Town.	
1	Alabama	Auburn	Agricultural and Mechanical College of Alabama
2	Arkansas	Fayetteville	Arkansas Industrial University
3	California	Oakland	University of California—Agricultural, Mining, and Mechanic Arts College.
4	Connecticut	New Haven	Yale College—Sheffield Scientific School
5	Delaware	Newark	Delaware College
	Florida		(1. No institution established in the State)
6	Georgia	Athens	Georgia State College of Agriculture and Mechanic Arts.
7	Illinois	Urbana	Illinois Industrial University
8	Indiana	La Fayette	Purdue University—Agricultural College
9	Iowa	Ames	Iowa State Agricultural College
10	Kansas	Manhattan	Kansas State Agricultural College
11	Kentucky	Lexington	Kentucky University—Agricultural and Mechanical College.
	Louisiana		(2. No institution established in the State)
12	Maine	Orono	Maine State College of Agriculture and the Mechanic Arts.
13	Maryland	Near Hyattsville	Maryland Agricultural College
14	Massachusetts	Boston	Massachusetts Institute of Technology
15	Massachusetts	Amherst	Massachusetts Agricultural College
16	Michigan	Lansing	Michigan State Agricultural College
17	Minnesota	Minneapolis	University of Minnesota: College of Agriculture
	Minnesota	do	University of Minnesota: College of the Mechanic Arts
18	Mississippi	Oxford	University of Mississippi—College of Agriculture and the Mechanic Arts.
19	Mississippi	Rodney	Alcorn University
20	Missouri	Columbia	University of Missouri: Agricultural and Mechanical College.
	Missouri	Rollo	University of Missouri: School of Mines and Metallurgy
21	Nebraska	Lincoln	University of Nebraska—College of Agriculture
	Nevada		(3. No institution established in the State)
22	New Hampshire	Hanover	Dartmouth College—New Hampshire College of Agriculture and the Mechanic Arts.
23	New Jersey	New Brunswick	Rutgers College—Scientific School
24	New York	Ithaca	Cornell University—Industrial Colleges
25	North Carolina	Chapel Hill	University of North Carolina—Agricultural and Mechanical College.
26	Ohio	Columbus	Ohio Agricultural and Mechanical College
27	Oregon	Corvallis	Corvallis College—Agricultural Department
28	Pennsylvania	Centre County	Agricultural College of Pennsylvania
29	Rhode Island	Providence	Brown University—Agricultural and Scientific Department.
30	South Carolina	Orangeburg	Claflin University—South Carolina Agricultural College and Mechanics' Institute.
31	Tennessee	Knoxville	East Tennessee University—Tennessee Agricultural College.
32	Texas	Bryan	Agricultural and Mechanical College of Texas
33	Vermont	Burlington	University of Vermont and State Agricultural College
34	Virginia	Blacksburg	The Virginia Agricultural and Mechanical College
35	Virginia	Hampton	Hampton Normal and Agricultural Institute
36	West Virginia	Morgantown	West Virginia University—Agricultural Department
37	Wisconsin	Madison	University of Wisconsin—College of Arts

have received the national endowment of land-scrip, act of July 2, 1862.

Date of acceptance of United States scrip or land by the State.	Acres in United States scrip or land granted by Congress to the State.	Acres in scrip or land received by the State.	Acres in United States scrip or land sold.	Amount for which United States scrip or land was sold for endowment of agricultural and mechanical college.	Date of incorporation of agricultural and mechanical college and transfer of United States scrip or land.
Dec. 31, 1868	240,000	240,000	240,000	$216 000	Feb. 26, 1872
Jan. 31, 1867	150,000	....	....	....	Mar. 27, 1871
Mar. 13, 1864	*150,000	....	....	....	Mar. 31, 1866
Dec. 24, 1862	180,000	180,000	180,000	135,000	June 24, 1863
Feb. 7, 1867	90,000	90,000	90,000	78,400	Mar. 14, 1867
Jan. 30, 1869	90,000	....	....	....	....
Mar. 10, 1866	270,000	270,000	270,000	243,000	Mar. 30, 1872
Feb. 14, 1863	480,000	480,000	455,000	364,235	Feb. 28, 1867
Mar. 6, 1865	390,000	390,000	390,000	212,238	May 6, 1869
Sept. 11, 1862	*240,000	†204,309	....	....	Mar. 29, 1866
Feb. 3, 1863	*90,000	†82,216	44,266	188,797	Feb. 16, 1863
Jan. 27, 1863	330,000	330,000	330,000	165,000	Feb. 22, 1865
Mar. 5, 1869	210,000	210,000	210,000	182,630	....
Mar. 25, 1866	210,000	210,000	210,000	118,300	Feb. 25, 1865
Feb. 17, 1864	210,000	210,000	210,000	111,000	Mar. 21, 1865
April 18, 1863 April 18, 1863	360,000	{108,000 {252,000 } 360,000	360,000	{$68,843 {167,464 } 236,307	April 27, 1863
Feb. 25, 1863	*240,000	235,673	27,874	92,444	Mar. 18, 1863
Feb. 14, 1863	*120,000	†94,119	22,394	128,266	Feb. 18, 1868
Oct. 30, 1866	210,000	{84,000 {126,000 } 210,000	210,000	{75,600 {113,400 } 189,000	May 10, 1871
Mar. 17, 1863	*330,000	{247,500 {82,500 } 330,000	330,000	....	May 3, 1870
Feb. 13, 1869	*90,000	90,000	....	....	Feb. 15, 1869
Feb. 13, 1867	*90,000	90,000	....	....	....
July 9, 1863	150,000	150,000	150,000	80,000	July 7, 1866
April 14, 1863	210,000	210,000	210,000	116,000	April 4, 1864
Mar. 14, 1863	990,000	990,000	465,000	428,350	April 27, 1865
Feb. 24, 1866	270,000	270,000	270,000	135,000	Feb. 11, 1867
Feb. 9, 1864	630,000	630,000	630,000	342,451	Mar. 22, 1870
Oct. 9, 1862	*90,000	90,000	....	....	Oct. 27, 1868
April 1, 1863	780,000	780,000	780,000	439,186	Feb. 19, 1867
Jan. 27, 1863	120,000	120,000	120,000	50,000	Jan. 27, 1863
Dec. 10, 1868	180,000	180,000	180,000	130,500	Mar. 12, 1872
Feb. 18, 1868	300,000	300,000	300,000	271,875	Jan. 16, 1869
Nov. 1, 1866	180,000	180,000	180,000	156,600	April 17, 1871
Dec. 1, 1862	150,000	150,000	150,000	143,000	Nov. 22, 1864
Feb. 5, 1864	300,000	{200,000 {100,000 } 300,000	300,000	{190,000 {95,000 } 285,000	Mar. 19, 1872
Oct. 3, 1863	150,000	150,000	150,000	90,000	Feb. 7, 1867
April 2, 1863	*240,000	240,000	153,400	182,970	Feb. 18, 1868

* States which have received land within their own limits instead of scrip.

† Number of acres diminished in consequence of selecting double-minimum lands, or from a rule adopted by the United States Land-Office.

Statistics, for 1871, *of the industrial institutions of the United States which have*

	LOCATION.		Name of the institution.	Date of acceptance of United States scrip or land by the State.
	State.	Town.		
1	Alabama	Auburn	Agricultural and Mechanical College of Alabama	Dec. 31, 1868
2	Arkansas	Fayetteville	Arkansas Industrial University	Jan. 31, 1867
3	California	Oakland	University of California—Agricultural, Mining, and Mechanic Arts College.	Mar. 13, 1864
4	Connecticut	New Haven	Yale College—Sheffield Scientific School	Dec. 24, 1862
5	Delaware	Newark	Delaware College	Feb. 7, 1867
	Florida		(1. No institution established in the State)	Jan. 30, 1869
6	Georgia	Athens	Georgia State College of Agriculture and the Mechanic Arts.	Mar. 10, 1866
7	Illinois	Urbana	Illinois Industrial University	Feb. 14, 1863
8	Indiana	La Fayette	Purdue University—Agricultural College	Mar. 6, 1865
9	Iowa	Ames	Iowa State Agricultural College	Sept. 11, 1862
10	Kansas	Manhattan	Kansas State Agricultural College	Feb. 3, 1863
11	Kentucky	Lexington	Kentucky University—Agricultural and Mechanical College.	Jan. 27, 1863
	Louisiana		(2. No institution established in the State)	Mar. 5, 1869
12	Maine	Orono	Maine State College of Agriculture and the Mechanic Arts.	Mar. 25, 1866
13	Maryland	Near Hyattsville.	Maryland Agricultural College	Feb. 17, 1864
14	Massachusetts	Boston	Massachusetts Institute of Technology	April 18, 1863
15	Massachusetts	Amherst	Massachusetts Agricultural College	April 18, 1863
16	Michigan	Lansing	Michigan State Agricultural College	Feb. 25, 1863
17	Minnesota	Minneapolis	University of Minnesota { College of Agriculture; College of the Mechanic Arts. }	Feb. 14, 1863
	Minnesota	do		
18	Mississippi	Oxford	University of Mississippi—College of Agriculture and the Mechanic Arts.	Oct. 30, 1866
19	Mississippi	Rodney	Alcorn University	
20	Missouri	Columbia	University of Missouri { Agricultural and Mechanical College. School of Mines and Metallurgy. }	Mar. 17, 1863
	Missouri	Rollo		
21	Nebraska	Lincoln	University of Nebraska—College of Agriculture	Feb. 13, 1869
	Nevada		(3. No institution established in the State)	Feb. 13, 1867
22	N. Hampshire.	Hanover	Dartmouth College—New Hampshire College of Agriculture and the Mechanic Arts.	July 9, 1863
23	New Jersey	N. Brunswick	Rutgers College—Scientific School	April 14, 1863
24	New York	Ithaca	Cornell University—Industrial Colleges	Mar. 14, 1863
25	North Carolina	Chapel Hill	University of North Carolina—Agricultural and Mechanical College.	Feb. 24, 1866
26	Ohio	Columbus	Ohio Agricultural and Mechanical College	Feb. 9, 1864
27	Oregon	Corvallis	Corvallis College—Agricultural Department	Oct. 9, 1862
28	Pennsylvania	Centre County	Agricultural College of Pennsylvania	April 1, 1863
29	Rhode Island	Providence	Brown University—Agricultural and Scientific Department.	Jan. 27, 1863
30	South Carolina	Orangeburg	Claflin University—South Carolina Agricultural College and Mechanics' Institute.	Dec. 10, 1868
31	Tennessee	Knoxville	East Tennessee University—Tennessee Agricultural College.	Feb. 18, 1868
32	Texas	Bryan	Agricultural and Mechanical College of Texas	Nov. 1, 1866
33	Vermont	Burlington	University of Vermont and State Agricultural College.	Dec. 1, 1862
34	Virginia	Blacksburg	The Virginia Agricultural and Mechanical College.	Feb. 5, 1864
35	Virginia	Hampton	Hampton Normal and Agricultural Institute	
36	West Virginia.	Morgantown	West Virginia University—Agricultural Department	Oct. 3, 1863
37	Wisconsin	Madison	University of Wisconsin—College of Arts	April 2, 1863

received the national endowment of land-scrip, act of July 2, 1862—Continued.

Date of opening agricultural and mechanical college.	Name of president of the agricultural and mechanical college and of the university.	Professors and assistants in agricultural and mechanical college.	Students in agricultural and mechanical college for collegiate year.	Annual interest on fund derived from sale of United States land or scrip.	Students in university and agricultural and mechanical college for collegiate year.
	Rev. I. T. Ticknor				
Jan. 22, 1872	N. P. Gates, A. M	2	92		
	Henry Durant, LL. D	10	95		262
*Sept. 29, 1847	Rev. Noah Porter, D. D., LL. D	25	123	$8,100	755
Sept. 14, 1870	William H. Purnell, A. M	6	30	4,992	
May 1, 1872	William LeRoy Broun				
Sept. 12, 1867	John M. Gregory, LL. D., regent	19	167	31,000	277
	Gov. Conrad Baker, president of trustees			17,500	
Oct. 21, 1868	A. S. Welch, LL. D	13	220	§31,000	
Sept. 3, 1863	Rev. Joseph Denison, D. D	10	194	23,000	194
Oct. 1, 1866	John B. Bowman, A. M., regent	30	212	9,900	660
				17,160	
Sept. 19, 1868	Rev. Charles F. Allen, A. M	10	42	8,458	
*Oct. 5, 1859	Rev. Samuel Register, D. D	10	136	6,732	
Feb. 5, 1865	John D. Runkle, Ph. D., LL. D	34	264	4,232	
Oct. 2, 1867	William S. Clark, Ph. D	22	166	8,464	
*May 13, 1857	T. C. Abbot, LL. D	12	141	6,471	
Sept. 15, 1869	William W. Folwell, A. M	4 3	95	7,557	321
	John N. Waddel, D. D., chancellor			8,000	
				12,000	
Sept. 27, 1870	Daniel Read, LL. D	12	29	†3,000	295
Nov. 23, 1871		4		†1,250	
	Allen R. Benton, LL. D., chancellor				138
Sept. 2, 1868	Rev. Asa D. Smith, D. D., LL. D	10	12	4,800	400
Sept. 30, 1865	Rev. William H. Campbell, D. D., LL. D	10	68	6,960	190
Oct. 7, 1868	Andrew D. White, LL. D	13	169	36,843	595
	Hon. Joseph Sullivant, secretary of trustees			27,579	
Nov. 25, 1868	Rev. W. A. Finley, D. D	6	22		143
*Feb. 16, 1859	Rev. James Calder, D. D	16	87	24,000	
Sept. 6, 1867	Rev. Alexis Caswell, D. D., LL. D	8	22	3,000	224
	Rev. A. Webster, D. D., president of University.				
Sept. 12, 1869	Rev. Thomas W. Humes, S. T. D	10	40	24,000	115
	Hon. John G. Bell, president of trustees			10,962	
Sept. 1, 1866	Matthew H. Buckham, A. M	8	27	8,580	126
Mar. 6, 1867	Rev. Alexander Martin, D. D	6	24	6,000	171
Sept. 15, 1869	Rev. J. H. Twombly, D. D	9	55	12,000	485

* Was opened as an industrial institution before receiving the national endowment of scrip or land.
† Revenue derived from rent of lands unsold.

INDUSTRIAL EDUCATION OF WOMEN.

The want of a system of education of greater breadth and depth is beginning to be keenly felt in this country; it is finding prominent expression in the endeavor to educe more clearly the dimly seen truths of natural science, and to apply those already attained to the work of every-day life. That is felt to be a poor style of culture for the present day which is mainly hidden in the life of the individual, and is not made to bear directly upon the industry, the art, and the productive effort of the country. If the education of males is too superficial, too narrow, and, especially, too unpractical, what shall be said of that of woman? To learn to pen gracefully a note of invitation, to sing a few staves of music, to finger mechanically piano-keys, to dance, and to simper affectedly, are chief accomplishments to which even the beginnings of solid culture are subordinate. Our systems for male and female are European, and should be Americanized. Zschokke, the good German, thus describes the falsity and frivolousness of female education in his country: "It is the chief fault of female education that girls are, even more than boys, educated to untruthfulness, pretenses, and dissimulation. We seek to root out of them the natural, unpretending simplicity and loftiness of their innocence, and to supply its place with a feigned nature." Who will say that much of our boarding-school culture is not of this character? What is needed in its place is thus hinted at by another German, Niemeyer: "The cultivation of the understanding, judgment, and reason, by studies in part of a generally useful character, in part adapted especially to the needs of the sex, should be the main purpose of their education." He would educate them with reference to their future duties, training them to industry and economy, and especially to domesticity.

We are inaugurating a new era in industrial education, in the establishment of colleges of agriculture and the mechanic arts. They are an experiment; will be various in character and efficiency; will make blunders, and some of them, at least, will eventually retrieve them and finally succeed. In the West, where they are laying their foundations far broader and deeper than those of the scattered and weak institutions numbered by the score in some States, they will be a power. Is not here an open door for a radical reformation of female education? Shall broad, practical, sensible culture be confined to boys? The fact that it is to be broad and various, suited to every position and business, answers the objection that the differing mental and physical constitutions of the sexes, and their different vocations in life, render their co-education in these institutions impracticable. Many agriculturists, indeed, think the foundations of some of these institutions too broad, endangering the success of the design for which they were originated; but, were they limited to agriculture, girls should not be excluded from participation in their advantages. While the larger portion of our population of forty millions are engaged in agriculture, and not one in ten of the entire number can expect to subsist absolutely without work, it is a necessity that women should have some knowledge of the principles and processes involved in rural arts. Not that women should hold the plow, or dig ditches, or build fences; there are occupations pertaining to agriculture essentially feminine, and rural and household arts in which women are qualified by nature to excel, but for which only scientific and general culture and specific technical training can thoroughly fit them. Women who must necessarily have some share in the work

of life, as all worthy of the name do have, will dignify and ennoble their own characters, instead of degrading them, in practicing these arts. Few subjects are of greater present importance than the

RELATIONS OF AMERICAN WOMEN TO RURAL INDUSTRIES.

As sensible beings, we must take facts as we find them. The almost universal necessity of labor must be recognized. In this country women have a higher development, taking physical, social, and industrial life together, than in any other. Immigrants bring their industrial and social habits with them, soon to be modified by American ideas. But we find that country women, whether of home or foreign birth, do actually take some share, and no inconsiderable share, in the labors pertaining to farm-life. Few appear to be aware of the part actually taken by women in rural affairs.

Woman's actual work in country life.—It is idle to indulge in sentiment and deplore the necessity of rural work for woman; the fact exists that millions of the human race, even in this country, must by the sweat of the face aid the transmutation of the soil into bread before it can be eaten, and of that class there are nearly as many women as men. It is true that the heavy work of the farm, the teaming, the "breaking up," and the drudgery, fitted only to sturdy strength, is done by men in this country, as it should be, and as it is not to such an extent in any other; it is true that in the new States, and in the Territories, where the face of woman is a vision of the past, a casual flitting of the present, and the special hope of the future, women are held quite too sacred even for the lighter rural drudgeries, not alone by the refined and cultivated, but by the chivalrous roughs of the border. It is equally true that no meager share of food production and preparation for the supply of our countrymen, and the surplus for European consumption, is allotted to the (physically) weaker sex.

Of the six hundred millions of pounds of butter, worth $180,000,000, how much comes from the labor of women in milking and churning, and all the cares of dairy management? Of two hundred and forty millions of pounds of cheese, worth $36,000,000, how much is manufactured by the wives and daughters of farmers? The eggs and poultry, amounting to many millions more, are due to an industry in which the farmer's wife has by far the larger share of skill and labor. The sweets of the hive are largely collected under the directing care of women. Millions of dollars, many more than those appearing in the census of market-garden products, are produced in kitchen gardens by feminine labor. No inconsiderable amount of small fruits, both for home use and for the village and city markets, is grown and picked by feminine hands; and the quantity and value of wild berries—strawberries, raspberries, whortleberries, blackberries, cranberries, and other kinds—would annually aggregate far more than the fortune of one millionaire. Then if the casual or regular labor of women, in assistance volunteered or required in planting, weeding, cultivating, haying, harvesting, and even the care of live stock, be computed at its true value, and its real percentage of our total farm production calculated, how would the figures swell the sum, and magnify the proportion of the wealth wrought from the mine of the farm by the hand of woman!

The correspondents of the Department frequently refer to the part taken by woman in rural labor in this country. A brief digest of this testimony to feminine industry in open-air service may be worth recording.

In New England very little regular labor in the fields is performed by women. The variety of in-door employments is such as to furnish work of a light and varied character, requiring every degree of skill. Yet in haying, laborers being scarce, the wives and daughters of farmers sometimes aid in spreading and raking hay. In planting, in a few cases, girls are wont to aid in "dropping" corn or other seeds planted in hills or drills. Women sometimes assist in milking, but not so generally as in former generations. In the care of poultry they still have by far the greater share. One report states that in some districts in Vermont one-twentieth of the farm-work is done by women. In Lincoln County, in Maine, a correspondent writes that "female out-door labor is unknown—incompatible with New England institutions." Girls are almost exclusively employed in hop-picking, wherever hops are grown, their nimble fingers rendering them superior to men or boys; but they usually receive but one-fourth the wages of men in the hop-yard. In Barnstable County, Massachusetts, the work of setting out cranberry-vines, weeding them, and picking the fruit, is mostly done by women; and they obtain for setting and weeding 10 to 12 cents per hour, the same rate paid to men, and 1½ to 2 cents per quart for picking, in which they average 1½ bushels per day. Women are more efficient than men at this labor. Canadian women, and occasionally Irish, hire out or work on shares in different parts of New England, though the number employed is not large; and they will undertake nearly all kinds of farm-work. "Many of them are as smart as the men," but as a rule they are less efficient and receive proportionately less pay.

Similar customs prevail in New York, comparatively little out-door service being rendered by American-born women. In tying hop-vines and picking hops, in which celerity in digital manipulation is a winning accomplishment—an occupation that is substantially an industrial picnic—they are universally preferred, and are paid "by the job," or according to the measure of work done. In picking grapes and other fruit, and in packing fruit for market, they excel, and in some districts find agreeable employment in such service. Most of the berries of New Jersey, grown so extensively for the markets of New York and Philadelphia, are picked by girls and women, at a given rate per quart, and they often make more than men at the same employment. In many districts in Pennsylvania very little out-door employment is undertaken by women, while in others, especially in those less improved, or with a large foreign element in the population, much and various farm-work is done by women. In Butler County, which has a large immigrant element, "the women assist in every out-door operation in which they can make themselves useful, so far as their spare time from the kitchen and dairy will permit, while their comfortable homes show that they do not neglect their household duties." These immigrants "not only do not lose their habits of industry, but are stimulated by the prospect of being able to accumulate enough to educate their children, and for sickness and old age." Agricultural machinery is reducing the proportion of female labor required in harvesting, yet a woman may occasionally be seen driving the teams which are the motive power in reaping and mowing, and one who can bind or gather grain with celerity and skill is not difficult to find. The assistance of women in out-door work is enjoyed to some extent in Delaware, especially in "saving corn-fodder," which is much used as a substitute for hay, and in picking peaches for market. The wages paid to women is said to be three-fourths of the rate allowed to men, and "their efficiency is in the same ratio."

Among the poorer classes of whites in some counties of Maryland, the

Germans especially, women assist in such labor as planting, hoeing corn, weeding tobacco, and raking grain. Sometimes they obtain men's wages, but usually about three-fourths as much. In such work they are often quite as efficient as men. Negro women have been accustomed to all kinds of farm-labor, though generally employed in the lighter branches.

Women assist in farm-labor to a very limited extent in Virginia. Since the war, the negro women object to field-work. Very generally, however, the "small farmers" have occasional assistance from wives and daughters, in most of the branches of service enumerated in the record of woman's work in other States. They are especially useful in "worming, suckering, and stripping tobacco," often more efficient than men, but receiving only one-half to two-thirds as much pay. In some counties full wages are paid for work in planting and gathering corn; full pay is often given binders in the wheat harvest who can keep up with the reaper. In Nelson County, "some are expert at cradling, and seem pleased with it, regarding it as more or less of a frolic."

Throughout the Southern States a large portion of the females among the negroes were accustomed to general farm-labor, most of whom now decline it, appearing to regard it as a relic of slavery, and not "suited to ladies." It is stated of some States that not more than a fourth part as many do out-door work as formerly.

White women in North Carolina, to a limited extent, render assistance to husbands and fathers who do their own farm work. In some districts of South Carolina it is said that "20 per cent. of the farm labor is performed by women, black and white. On an average they are not paid more than half the wages of men, and their efficiency is in the same ratio." Very little farm work is done by women in Georgia, in assistance at home, never hiring out, except in some instances, at cotton-picking. Yet there are instances reported, as in Cherokee, in which "a few widows manage their farms without any adult males to help; and they plow, hoe, harvest, bind, and gather their crops, shear sheep, and carry on all farming operations." Similar cases are found in all the Gulf States. In the harvesting of the cane, and in the operations of sugar-making, female labor is found efficient; while, in another State, a crusty bachelor maliciously hints that the agricultural occupation preferred by women in his section is "raising Cain." A large portion of the gardening of Duval County, Florida, is done by women. In Louisiana, Mississippi, and Alabama, white women upon small farms assist in field occupations more than formerly. Picking cotton is preferred, and when employed for wages, pay is proportionate to the work accomplished. Occasional aid in the light work of the farm, as cotton-seeding or cotton-picking, is given in Texas, Arkansas, and Tennessee. Among the rich lands and large farms of Kentucky very little out-door work is done by women, either white or black; but in the less opulent hill regions white women do more farm work, and black women less, than formerly. In Missouri, where the same general statement holds good, it is said that "one woman in a garden or at the sorghum-kettle is considered equal to two men." Very little farm work is done by native Americans in all the States of the Ohio Valley and the lakes, that little being casual assistance in emergencies, as a matter of convenience and sometimes of necessity, as is reported of all other sections of the country. Gardening and fruit-picking are preferred, and hop-picking, where hops are grown. Immigrants do more out-door work, "especially for a few years after coming here. As they become Americanized they work less on the farm." "They do all kinds of farm work," says a correspondent in Wisconsin, "and many kinds as well as the men." As hop-pickers, in

the Northwest, they are preferred to men, and secure the same pay, but for most farm work do not receive more than one-half or two-thirds of the wages of men. In Minnesota female immigrants work extensively in all branches of farming. "In binding and shocking grain, some of them are equal to the best of men." Some of them, in times of scarcity of labor and high rates of wages, have received $2.50 to $3 per day, when male laborers obtained $3 to $3.50.

In Kansas the kitchen-garden is generally in charge of the mistress of the farm-house. When employed for wages, women get about the same as men for the same amount of work, though this is not invariably the case. In some counties in Nebraska no out-door work of women is reported; in others much is done in haying and harvesting, some can bind as much wheat as men, "though they cannot bind it so tightly," in which cases they get the same pay for it. A correspondent says: "The day is past in progressive Nebraska for the 'weaker vessel' to get less pay than men for the same work." In Utah it is claimed that women do not generally work out of doors. One report admits that women assist occasionally at harvest, and that they receive half the rate of wages paid to men. Less farm-work is done by women in the Pacific States and in the Territories than elsewhere, on account of their comparative paucity of numbers.

Farm management.—There is a higher aspect of woman's rural work—that of farm management. The presumption might be natural that, with no special training, no experience, and little theoretic knowledge of agriculture, failure would be certain. Were women generally to undertake it without practical knowledge, failure might reasonably be expected. As those who become farmers generally assume the business of farming from necessity, as upon the death of a husband, with no resources except those to be developed through the processes of agriculture, they must necessarily be "terribly in earnest" in their endeavors, with caution stimulated by a thought of the consequences of failure to their dependent children, and persistence strengthened by the hope of comfort and competence, with education and social standing for the youth of the household. If one thus left alone distrusts her ability to earn a living from the farm, she sells it, leaving to enter the ranks of managing farmers mainly the women of some confidence, of persistent energy, of resolute will, and a decided taste for the business. This may explain what the records of the Department show, so far as the facts have been reported, that women succeed as farmers in about the same proportion as men. A few examples of the many reported will illustrate the subject.

Two unmarried daughters of the gallant General Miller, of "I'll try, sir" fame, living in an interior hill town in New Hampshire, have for years managed a farm of scarcely average fertility, which they have improved without outside resources. They lead the neighborhood in the cultivation of fruits and flowers, and in the production of gilt-edged butter, which commands a fancy price in the Boston market. They pay liberally for labor, and deal generously with local enterprises for social and moral improvement.

An aged couple in Washington County, New York, owned a farm of 250 acres. As they became incapacitated for its management, one of the boys assumed control, but soon made a failure, and was followed in succession by several brothers, until the homestead became almost hopelessly incumbered. Then a maiden sister accepted the trust, and in eight years, without other capital for its improvement, removed all

incumbrances, and placed the paternal acres in a flourishing and productive condition.

A widow in Columbia County, Pennsylvania, whose husband died in debt, involved herself by the purchase of his personal property at the sale of his effects, and managed the farm with economy, skill, and judgment, producing excellent crops in summer, making money in winter by her success in stall-feeding; and she now owns 150 acres, clear of all incumbrance, has built a new house, improved the farm, and is regarded by her neighbors as in all respects a successful farmer.

In Duval County, Florida, report states that twenty farms are managed successfully by women, mainly war-widows compelled to find support for their families. One, with two daughters, does all the farm-work in that warm climate, and has harvested in a single year 100 bushels of corn, 200 bushels of sweet potatoes, and cultivated 1½ acres in cane.

A woman in Washington County, Texas, owning a farm of 500 acres at the close of the war, has made $75,000 upon it since, and now desires to retire for the education of a daughter.

In more humble life successful cases occur. In Boone County, Kentucky, a young woman was left a widow with several children and $800 in money. She bought land, supported her family, gave each $3,000 for a start in life, and at the end of twenty-eight years had remaining a property worth $11,000.

Not only do many make a living and attain a competency, but they prove good farmers. A correspondent in Harrison County, West Virginia, says: "My neighbor, a widow, raises better corn, wheat, oats, &c., than any of her adjacent neighbors."

An Ohio correspondent, in Holmes County, tells of the success of a woman in managing a farm of 160 acres, who sells sheep, wool, butter, eggs, and other products, and from her profits is able to loan money; and yet she is only assisted by a son, not yet grown, and one hired laborer. There is another case in Mercer of a woman who kept the homestead, her husband dying in debt, paid off all obligations, and at the end of ten years has a productive farm.

There are cases of success under conditions of peculiar hardship. A woman in Michigan, left a widow with four children, too distrustful of her resources to risk the employment of help, carried on alone a farm of 80 acres, with such assistance as she could obtain from her children, yet she raised good crops and good stock, and prospered.

In Greene County, Wisconsin, two orphan sisters manage the paternal estate with eminent success, doing much of the labor with their own hands, both in agriculture and horticulture. In Columbia County a farm of 160 acres is managed by a widow with far more successful results than her husband was able to secure in his lifetime. In Crawford a woman, left a widow with a family of small children, with an incumbered farm of 160 acres, has paid up the mortgage and laid up money. She displays business tact in buying her supplies and selling her products. Another in the same county, with a family of four small boys, conducts a farm successfully, drives her own reaper, and knows well how to drive a bargain. Another correspondent writes of a muscular maiden in the same State, twenty-one years old and six feet high, who delights in chopping wood, splitting rails, breaking colts, and holding the "breaking-up plow," and is an excellent marksman with a rifle, doing all these things with masculine skill. Of course her example is not to be commended, though a better one for the race than that of some gossamer embodiments of an effete civilization.

There are many cases reported in Illinois in which women, generally widows, manage successfully large farms.

In that young State, Kansas, are already similar instances. In Nemaha County, a young widow managed a cheese dairy of twenty cows successfully, accumulated property, "attracted the attention of a rich widower from Illinois," the result being a union of both fortunes. Several farms of 160 acres each are well managed by women in Osage. In Jackson, a widow with six small children cultivates a tract of 40 acres, hiring occasionally a horse or pair of oxen for plowing, and performing all the labor of the farm, with better results than her neighbors obtain from their labor. A similar case is reported in Davis County.

These cases appear to be those arising under the spur of necessity. Widows with children to support cannot be governed in their life-work by considerations of æsthetics, or of womanly reserve; waiting mouths must be fed. There are others who want not subsistence but substantial occupation. They find it in the domain of nature, and with it health, cheerfulness, and contentment. An example is given in Lippincott's Magazine, from that stigmatized class, "old maids," which will represent many others of somewhat similar character:

> I know two women who may be classed in this category—unmarried, forty years old, or thereabouts. Both are of good family, the daughters of wealthy men. The one, some dozen years ago, finding, as no sensible woman can fail to do, that fashionable life had nothing in it to satisfy her, made a stand for herself. She told her family that she must have a life of her own. She had no especial gifts, except a remarkable aptitude for business, inherited from her father. In a quiet way she had turned her attention to fruit-growing, a branch of industry offering many attractions to her, and into the business she determined to enter. Fortunately, she had sufficient money, left her by her grandfather, to be able to carry out her plans, despite the sneers of her fashionable acquaintances, and the objections and obstacles raised by the home circle. She established herself on a fruit-farm in the western part of this State, (Pennsylvania.) Her work prospered. Now she is the owner of several hundred acres, and has constant remunerative occupation of a kind agreeable to her. After a few years her father died, and, instead of the rich man he was estimated, he was found to be a bankrupt. This daughter had a comfortable home and support to offer her mother and invalid sister. She has quite a settlement of people, men and women, to whom she and her sister minister in various ways. In fact, she lives a life which is useful to others and develops her own powers, and in the consciousness of that, enjoying happiness and peace.

There appears to be something ennobling in this enforced self-reliance and thoughtful industry, which has a reflex influence in establishing in the character of their children elements of manliness and sobriety. A correspondent in Clay County, Kentucky, writes: "It is a remarkable fact that widows have raised the best children, less addicted to intemperate habits than those who have fathers, and have provided for them more of the comforts of life. Generally, in this region, it is only necessary to know that a young man has been raised by a widow to entitle him to the fullest confidence; and he is usually found industrious, intelligent, economical, and moral."

Her proper share in rural labor.—No true woman or sensible man would advise a course tending to impair the delicacy of feeling natural to a woman of refinement. Communion with nature, with the heavens for shelter, and the sun for warmth, has no such tendency, though promotive of health and cheerfulness, strength of muscle, and elasticity of spirit. There is general complaint of want of opportunity for profitable employment of woman. There need not be. Most of the prevalent education of girls fits them only to be teachers of primary schools, and a glut in the market for common-school teachers exists, and rates of wages therefore rule low. Yet there are a few female teachers with salaries of $1,000, $2,000, and even $2,500. Make education practical,

suggestive, a living reality, and not a thing that withers on leaving school and dies with marriage, and new and congenial avenues of profitable effort will be opened, and many of them will lead into the country, and be embowered in verdure, perfumed with flowers, and enriched with luscious fruitage. A school of horticulture for women, theoretic and practical, is in operation in Massachusetts in connection with the Bussey Institution. Many have taken a short cut to a horticultural education, and achieved success in practice. A maiden lady in Southern Indiana leased a few acres in fruit trees, which a man had failed to cultivate properly, and has been able to buy the place and hold a surplus in cash. Such instances are multiplying rapidly. Some women are making a profitable specialty of flower culture; flower farms for perfumes may be next in order. The raising of certain flower-seeds might furnish agreeable and profitable employment. There is almost endless variety in the specialties for which a young woman may be practically educated, in the culture of flowers, seeds, fruits, and vegetables. Poultry-keeping is profitable as a separate business when properly managed, but is safer as an adjunct of the farm. Few are aware of the impetus given to bee-keeping by the successful practice and editorial teachings of Mrs. E. S. Tupper, of Iowa, who is associated with Mrs. Savery, at Des Moines, in the rearing of Italian queens. The following note from Mrs. Tupper will faintly indicate the interest and profit which women find in the business:

Within the past four years many women have been turning their attention to bee-keeping as an occupation—pleasant, easily managed, and remunerative. We are glad to know that in every instance which has come to our knowledge, success most marked has attended the undertaking. From reports that have been made to us, we condense the following instances: One young lady who had been teaching for several years, and whose health had failed, undertook the care of her father's bees, twelve colonies in number, that had never been profitably managed. Under her care the first season they increased to thirty colonies, and the third season after she took them in charge she sold $1,200 worth of honey, and had in the fall fifty-four strong colonies in good hives. She says: "The time I devoted to them I did not miss, and the pleasure afforded by the work was so great that I would enjoy doing it even if no profit were derived."

A widow, with scanty provision for her support, turned her attention to bee-keeping. She purchased ten poor hives in the spring for $50, and expended about as much more for good hives. The first season's yield of honey gave her back her investment and $36 over. The second season she sold $900 worth of honey, and her stock of bees that fall numbered thirty-two colonies, all strong. We know of more than one hundred women who are successfully building up apiaries, but have no record of a single failure. Several have assumed the care of their husbands' bees, and find them a source of profit.

The largest apiary in the West is now in Des Moines, managed entirely by women, who are doing a large business in importing and rearing Italian bees, as well as in the sale of honey. From the South we hear of many who are engaging in the business, and it is to be hoped that many others in that region of flowers will be induced to enter upon it, and help convert that which is now wasted into a source of wealth.

Another letter, detailing the experience of Miss Kate Grimm, of Jefferson, Wisconsin, relates that in 1870 she had charge of one of her father's apiaries, one hundred and seventy-eight old colonies, which increased by swarming to two hundred and eighty-five. She obtained 2,000 pounds of extracted honey, which was sold for $320; 5,000 pounds of box honey brought $1,200; forty-seven new colonies were sold for $423; and the value of combs of united colonies was $90; in all $2,033. In 1871, beginning the season with fifty-six colonies, she obtained 3,700 pounds of extracted and 2,875 of box honey, and the total product was $1,694. She is a school teacher, but says in her note that she is "convinced that a person can earn ten times as much by taking care of bees."

These brief suggestions are only hints to possible rural avocations for

woman, and by no means an enumeration of them. But these will suffice to attract the attention of energetic women who desire to enlarge their usefulness without diminishing their self-respect or lowering their social standing.

THE INDUSTRIAL EDUCATION REQUIRED.

The general idea of the education now needed for the boys and girls of the farm, is expressed in the words of the writer printed in a previous report: "Delving in classic mines through weary years, till the atmosphere of the present is moldy with the emanations of the dead past, will not suffice for the activities and practicalities of this living age. The theory and philosophy of language must take a high place in American education; but science, in its myriad applications to art and invention, opens a field inviting, alluring, and boundless, which promises more of good and glory than any other path of learning. It is a new path. Alas! how little do the 'masters' of special branches of science at present know of the treasures of which they have caught but glimpses, and how powerless are they to apply this knowledge to human arts or the wants of man!" It should be uniform for all "so far as it may be necessary for social harmony and a proper mental balance, and specific to suit the peculiar wants of the individual." It should be alike for both sexes in the principles and precepts which underlie all human action, and specific in their application to the peculiar sphere and range of industries to which each sex may properly be called. For women, it should, of course, involve the philosophy and chemistry of all household arts, and thus cause the overthrow of the tyranny of the kitchen and the dynasty of ignorance, while preserving the health and, perhaps, saving the life of the family. And what can be more effectual as a means of culture, of attaining intellectual and moral elevation, than an investigation of the laws of vegetable physiology, and an acquaintance with the conditions which affect vegetable and animal health and growth?

Circumstances may arise in which a knowledge of the application of these principles to the processes of agriculture may be necessary; in fact, may not such knowledge be valuable to the wife and daughters of any farmer? But there are industrial arts which have been, and probably will continue to be, measurably controlled by women. The care of the farm dairy, the preservation of fruits, the preparation of fruits for market, the keeping of bees and poultry, the care of the flower-garden, and sometimes the management of the vegetable garden, will continue to furnish congenial and profitable occupation to women; and in all these avocations, applied science will enhance skill and more certainly insure success. A practical education, if supplemented with a knowledge of what is essential in literary and polite accomplishments, will deepen and intensify female charms of mind and person in all healthful and rightly constituted society.

THE POSITION OF OUR INDUSTRIAL COLLEGES.

In the free and progressive West the doors of industrial colleges are thrown wide open for the admission of women. In the East the sex is knocking persistently for permission to enter. The officers of the Agricultural College of Vermont have decided upon admission without distinction of sex, beginning with the year 1872.

Women were not received in the Pennsylvania Agricultural College for twelve years of its existence. After a careful consideration of the

question, the trustees decided that they could not take the responsibility of denying its advantages to half the youth of the State, and voted, in 1871, to admit both sexes upon equal conditions. They therefore announce that "ladies are now admitted to the same courses of study as the gentlemen, are subject to the same rules, and, on completion of their studies, will receive the same certificates and degrees. Such separation of the sexes, and variation of labor for instruction and exercise as prudence dictates, will be carefully secured; but the privileges enjoyed will be equal, and the advantages derived from a residence at the college will be as great in one case as in the other."

The Wisconsin University, a branch of which is the land grant agriculture college for that State, has adopted a plan which combines "co-education" with instruction, having organized a "female college," and erected a building at an expense of $50,000, in which a separate course, under lady teachers, may be taken, and, at the same time, the privilege is accorded, at the option of the young women, of reciting in any of the classes of the university. The number in attendance during 1871 was 120. The report of the president of the board of regents certifies that "the ladies showed a scholarship not inferior in any respect to that of the gentlemen."

In the Michigan institution girls are making rapid progress in botany, chemistry, horticulture, surveying, and other studies. They are permitted to test and extend their horticultural acquisitions by practice in preparing seed for the ground, care of the lighter plants, trimming of shrubbery, and similar work.

Mr. W. C. Flagg, Corresponding Secretary of the Illinois Industrial University, thus writes upon this subject:

> Although there was considerable difference of opinion in the board of trustees as to the expediency of educating the young men and women of our State together; and although no proper dormitories or special industrial training can yet be furnished for young ladies, still, in view of the general demand on the part of the people, and perhaps from the fact that there exists no legal right to exclude them, the young women of the State began attendance at the fall term of 1870, and have been represented in the university ever since. Their attendance in the academic year 1870-'71 amounted to twenty-four, and the number now in the university (October, 1871) is about forty. Most of the young ladies are from adjoining towns, and board at their own homes. The studies thus far are largely those of the college, of literature, science, and art especially; English literature, mathematics, German, and French languages. About a quarter of their number are engaged in the study of chemisty, and four in laboratory practice. Over half of the whole number take lessons in free-hand drawing. There has been no development as yet of special studies for young ladies, but a number are in contemplation, which will be undoubtedly of advantage. Wood-engraving furnishes a fitting and profitable employment for women. Chemistry, in its application to household arts, opens a wide field of profitable study to the future housekeepers of our State.

Dr. Gregory, the regent, testifies that the government of the young men is much easier since the admission of young women to the university. He reports favorably upon the progress of the latter in the theory and practice of the rural arts, aided by illustration in the actual orchard, nursery, forest, greenhouse, and market-garden.

The Iowa College was one of the first to admit girls to its privileges. The officers report the complete success of the experiment. The number of males pursuing their studies there during the present year is 141, of females 51. The girls occupy one entire wing of the college building; a matron is in superintendence; there is a general housekeeper, and the housework is all done by the students. The president reports the apparent equality of his students, male and female, in intellectual capacity, and acknowledged recently his best analytical chemist in the laboratory to be a girl of seventeen years. As to difficulties, involving watchfulness and discipline, he declares he should have twice

the difficulty in managing without the presence of the girls. The faculty are trying, with successful results, the plan of self-government, the power of discipline being lodged in a court consisting of five young men and two young women. Under this system the number of cases brought to trial is decreasing.

Cornell University has also thrown down the barrier to the equal and full education of women. President White has given publicly his adhesion to the practicability and desirability of co-education of the sexes.

The Oberlin College, in Ohio, the pioneer in co-education, has 84 female graduates. Its proportion of lady students has, for many years, been from one-third to one-half. From 400 to 500 are present annually. The results, after an experience of nearly forty years, are eminently satisfactory.

In the University of Missouri, of which the Agricultural and Mechanical College is a part, several young ladies now recite in advanced classes. The curators make this sensible point: "Shall we, in establishing a great university of the State, ignore and pass by one-half of our people? Shall women be excluded from the advantages, as though they were outcasts? Or, while they are admitted in name, shall they in reality be shut out, because no provision is made to receive them?" They favor the establishment of a separate and distinct college for women, with its own board of supervisors, and the admission of its members to recitations and lectures in all departments of the university, "thus preparing for the care of the sick-room and the kitchen, and elevating, by science and art, the commonest duties of home life." They enthusiastically ask, "Will not the women of the State, and from every part of the State, make their appeal to the legislature for the equal rights of their sex in the State University?"

Professor E. W. Hilgard, occupying the chair of agricultural chemistry in the University of Mississippi, in a report to the chancellor on the organization of the "Department of Agriculture and the Mechanic Arts," under the land-grant provision, thus recommends a new feature in southern education:

> A striking feature in all, or almost all, the western colleges is the unquestioned admission of young women to any of the courses they may desire to follow; and the universal testimony goes to show that not only do they, as a general thing, fully hold their own as compared with the male students, but that their influence on the behavior and diligence of the other sex is extremely beneficial. It may perhaps be fully assumed that the benefit is reciprocal; but it has been a matter of surprise to me to find almost the same courses prescribed to both sexes. Though not in accordance with the "advanced" views of the times, it has seemed to me that a course in *housekeeping*, in all its branches, might advantageously be substituted for some of the studies now pursued.

A committee appointed to visit several western institutions, with reference to a plan of organization of the Arkansas Industrial University, has earnestly recommended the system of co-education of the sexes, from an examination into its results where it has been in operation. The university now admits both sexes, without regard to sect or race, making the minimum age for admission sixteen years for boys, and fourteen for girls.

Thus is the new education everywhere taking a "new departure," and vindicating its claim to breadth and freedom from hereditary exclusiveness and class distinctions. Throughout Europe the facilities for female education are increasing, and its standard rising to a higher elevation. Great progress in this direction has recently been made in Russia, and England and France are also advancing. It is fitting that the last relic of feudal inequality, in the comparative opportunities for the highest education of both sexes, should disappear in the United States.

DIGEST OF STATE REPORTS.

IOWA.

The report for 1870 of the Iowa State Agricultural Society, by Dr. J. M. Shaffer, secretary, contains, besides the usual reports of the treasurer, of standing committees, of county societies, and of the State Horticultural Society, essays on the agricultural advantages of Iowa, and inducements to immigration, how to make prairie homesteads beautiful, fattening cattle, feeding hogs, planting and cultivation of forest-trees, and general farming.

In a general review of the year the secretary shows that a greater breadth of corn, wheat, rye, and oats has been cultivated than in any previous year. The yield is a full average and the quality greatly superior. The potato-crop is enormous; fruit a great failure. The losses of farm stock from diseases not specifically defined are large. Wool-growing, from dissatisfaction with low prices, has decreased. Great improvement has been made in blooded cattle, horses, swine, and poultry, from importation of breeds of recognized superiority and excellence; and in the adornment of homes and farms, and the construction of permanent residences for the family for generations to come, instead of temporary abodes ready to be sold at the first opportunity. Farmers' clubs, literary organizations, lyceums, and libraries have been multiplied, and the diffusion of agricultural and newspaper literature greatly increased. Laws have been enacted to restrain stock from running at large, for the protection of birds, and to prevent cruelty to domestic animals in transportation and other ways.

The committee of the State Horticultural Society recommend for the location of orchards, on the prairies of Southern Iowa, the highest and driest rolling ground, with a southern slope. If the ground is only slightly rolling or nearly level they would ridge it up well, leaving a deep furrow in the center, between the rows of trees, in the direction which will carry off the surface-water readily. The trees should be set at least 25 feet apart each way, the roots being covered 3 inches deeper than in the nursery, when planted in Southern Iowa. But in the western part of the State, on the Missouri Bluffs, they should be covered considerably deeper, the soil being so porous that they are liable to die in summer from want of moisture, and in winter from too free action of the air on the roots when frozen. No grass or small grain should be allowed to grow in the orchard while young. It should be cultivated with corn and kept clean of weeds till the trees are large enough to bear. The spring is considered a better time for planting trees in that State than the fall, and they should never be planted when the ground is wet. It is a good plan to dip the roots in water before setting. No water should be poured around the tree after it is set, unless it is thoroughly mulched. Good clean cultivation and frequent stirring of the surface-soil are better than water. If water is used at all it would be better to sprinkle it on the tops of the trees about sunset. If the weather is very dry it may be applied often.

The committee recommend the following list of market-apples for cultivation in Southern Iowa: For summer, the Early Harvest, Red Astrachan, Red June; for fall, the Kentucky, Maiden's Blush, Rambo; for winter, Rawle's Janet, Wine Sap, Ben Davis, Willow, Jonathan, Grimes' Golden. These varieties combine in a high degree the three indispensable qualities for market-apples, namely, large yield, fine appearance,

good quality of fruit, and sufficient hardiness to endure, without injury, the changes of climate to which they are subject.

Mr. L. J. Young, of Chickasaw, Chickasaw county, says that in Northern Iowa almost any location will answer for an orchard, except the rich river and creek bottoms. The best location, however, is the high and dry summits of the white-oak ridges, on a soil usually called poor. The advantages of such a situation are freedom from frosts in in spring and fall, and a soil not so rich as to produce an overgrowth of the tree. The tree, therefore, ripens its wood and is rendered sufficiently hardy to withstand the severe cold of winter. On ridges, also, there is not the extreme variation of atmospheric temperature that occurs on the bottom lands. In the day time the temperature in a hollow protected by high bluffs and trees will be several degrees warmer than on the bluffs; but in the night the case is reversed, and in the valley it will be five to ten degrees colder than on the bluffs, thus exposing the trees to greater extremes of heat and cold than when on the ridges or bluffs. High swells of the prairie also make very good sites for orchards, but the greater fertility of the soil makes it necessary to cease cultivating the trees earlier in the season.

The committee chosen to make a list of the best market varieties of the apple for the climate of Northern Iowa recommend, for summer, the Tetofsky, Red Astrachan, Sops of Wine, Duchess of Oldenburg; for fall, the Saxton, Saint Lawrence, Fall Orange, Gros Pommier; for winter, the Fameuse, Plumb's Cider, Perry Russet, Blue Pearmain, Ben Davis, Rawle's Janet, Talman's Sweet. This list, like the former for Southern Iowa, was made with much care. The fruit of most of the varieties is of excellent quality, and in hardiness the trees may be safely classed as "iron-clads."

It is the opinion of the Horticultural Society that the Philadelphia and Black Cap raspberries are the best varieties for growing in Central and Southern Iowa, being hardy, prolific, and requiring comparatively little care in cultivation. The Philadelphia succeeds on light sandy lands, is of fine size, and sells for a large price. The Black Cap is highly esteemed for cooking, as well as for a dessert for the table.

The bluff-lands on the Missouri and Mississippi Rivers are well adapted to the culture of grapes. They succeed finely in Pottawattamie county, diseases of the fruit or vine being very rare. The Concord variety is generally cultivated. Des Moines county has about sixty vineyards, covering in the aggregate 250 acres, about 1,200 vines being planted on an acre, making in all 300,000 vines. About half are the Concord; the remainder the Catawba, with a few others. The crop the past season was 900,000 pounds, averaging three pounds to a vine, and selling at 6 cents per pound. The amount received for them was $54,000. This estimate does not include the gardens, which would probably equal about 40 acres. The vines sometimes suffer slightly from winter-killing, but the loss from this cause is so small that it diminishes the profit of culture but little.

The Early Rose potato is quite extensively cultivated in Louisa county, and with the best results. The tubers are of excellent quality, and the yield is large. Mr. James Pemble, of Wapello, is represented to have raised two crops of this variety the present season, on the same piece of ground. Both matured fully, and together yielded about 500 bushels per acre. Some of the potatoes weighed three and a half to four pounds each. Much attention has been given in this county to the improvement of breeds of hogs. The Chester White and Magie are

considered to be among the best. The Poland and Spotted China have been introduced, and are both thought to be very fine.

Mr. J. L. Budd, of Shellsburgh, Benton county, chairman of the committee on hedges, considers the honey-locust (*Gleditschia triacanthus*) the best plant that can be found for field-hedges in Iowa. It is perfectly hardy, and in six years will form a hedge impenetrable by man or beast, and flourishes equally well in Maine, Wisconsin, Iowa, and New Jersey. There is a hedge of this plant at Elizabethtown, New Jersey, one mile in length; all its parts have been subjected to annual pruning; it has maintained perfect health and beauty for forty years, and is pronounced by competent judges to be one of the finest hedges in the United States. The whitethorn (*Cratægus tomentosa*) and the buckthorn (*Rhamnus catharticus*) come next in value. For a hedge near the house, in a country town, the English barberry (*Berberis vulgaris*) is preferred. It is stronger than the American barberry, (*Berberis canadensis*,) but does not attain sufficient strength for an outside fence until twelve years old, unless wires are drawn through it. After six years' growth, with two wires, it can be relied upon for a fence. It is very beautiful, especially in the fall season, when covered with a profusion of scarlet berries. All the foregoing will continue during the natural life of the plants. The Osage orange (*Maclura aurantiaca*) makes a fine hedge, but will not endure the climate of Iowa. For a low evergreen hedge the arbor-vitæ (*Thuja occidentalis*) is unequaled in the climate of Iowa. It should be kept pruned into a pyramidal wall, not more than three or four feet high.

Mr. H. Ellis, of Marshalltown, reports that the timber forests of Marshall county are being thinned rapidly, but the loss is partially supplied by cultivated trees. Nearly every farmer sets some forests trees every spring, but the attention of the people is not yet sufficiently aroused to the importance of the subject. Mr. Suel Foster, of Muscatine, Muscatine county, recommends the planting of forests not only for the timber and wood, but for beautifying the landscape, increasing the value of the farm, diminishing the force of the winds, and for modifying the heat in summer and the cold in winter. He regards the European larch as the best tree for timber-planting in Iowa. It is of rapid growth, growing half an inch or more in diameter yearly during the first ten years, and fully an inch yearly in the next ten. The timber is durable, tough, and strong, and is well fitted for almost all building purposes. He would advise farmers not to attempt to raise their larch-trees, but to buy them when about two years old, at the common price of $10 to $15 per thousand. The ground should be prepared by plowing very deep in autumn, and again in the spring as early as practicable, and harrowing till the surface is well pulverized and smooth. The trees must be lifted very early in spring, and never allowed to dry in the least. They may be planted in rows 4½ feet apart, and 1 foot in the row, their roots having been dabbled in thin mud before setting. A man using the spade and a boy handling the trees will set about 2,000 in a day. They will need to be cultivated carefully by plowing and hoeing in May and June for two years, and if the land is very weedy, the third and fourth years. The cost of 8,000 plants, the usual number necessary for an acre, is $80; plowing and harrowing the land before setting, $4; setting, $8; plowing and hoeing the first year, $8; second year, $4; third and fourth years, $4; interest on land, valued at $50 per acre, for eight years, $32; total cost of an acre of European larch eight years old, $140. Credit during the same period by 3,000 plants, at $20 per thou-

sand, thinned out after two years' growth to be set in other ground, $60. It is calculated that 1,000 trees in 8,000 will die, but those accustomed to cultivating them will not lose so many. Half the plants, allowing 1,000 loss by dying, are now removed, leaving them 2 by 4½ feet apart. When eight years old they will be 2 to 3 inches in diameter, and 15 to 20 feet high. Two thousand more may now be removed, leaving them 4 by 4½ feet apart. At 5 cents apiece the poles from these are worth $100. At eight years old an acre has cost $140, and is credited by $160 for trees sold. These planted out again, at two years from setting, should be placed 4 by 4½ feet apart, covering about one and a half acres, and will cost for setting and cultivating two years, including cost of plants at $60, something over $100. For fencing Mr. Foster would use larch for posts and soft-maple for rails. He has good authority for saying that soft-maple rails, when cut in summer, peeled, and thoroughly seasoned before using, have been known to last in Marshall county twenty years. It is surprising, he says, to see how large a quantity of fencing material may be obtained in six, eight, or ten years, from an acre of these rapidly growing trees.

Mr. Eber Stone, of Lott's Creek, Humboldt county, says that the cotton-wood, (*Populus monilifera*,) for immediate use and quick returns, is "emphatically the new settler's grove-tree." In a given time it will probably make more fuel, more clear lumber, and afford better protection than any other tree yet tried. If raised in a thicket it will self-prune and make a tall, straight growth; but with ample space it forms a beautiful spreading ornamental tree. It is very tenacious of life, and readily bears transplanting; or it may be propagated with facility from slips cut in the winter when not frozen, and kept without drying till planted in spring. He prefers, however, to cut them just before setting, using only the last year's wood; but older wood will do. They should be about 10 inches long, whittled to a point at the lower end, and as soon as the frost is out of the ground set in rows 4 feet apart each way, and so deep as to leave only two buds above the ground, which gives them sufficient depth to withstand a severe drought. When forests are planted for all uses, and without regard to time of growth, a variety of trees should be selected, as the soft maple, sugar maple, white ash, black walnut, chestnut, butternut, &c. Mr. Stone prefers to plant the seeds of these trees in rows north and south, 4 feet apart, and 6 inches in the row, thinning out to such a distance as is thought necessary. For the first four years they should be kept clean of weeds, but after this no cultivation is generally needed. The seeds of the soft maple mature from the middle of May to the middle of June, and must be gathered and planted before drying to a depth a little less than corn. Those of the white ash are gathered from the middle of October to the middle of November, and may be planted immediately after gathering if the fall is favorable, or in the spring as early as the ground is in good condition to be cultivated. When placed in open, shallow boxes partially sunk in well-drained ground and covered a foot or more deep with manure partly decomposed, they will keep safely till time for planting out in spring. For raising butter-nut trees, the nuts should be planted as soon as practicable after they fall in autumn, and be cultivated in the same manner as soft maple. Evergreen trees may be set out any time in the spring, after the ground is in a proper condition, before they begin to grow. They should be mulched the first year with barn-yard manure or other substance, and shaded with boards when the weather is hot and dry.

The secretary of the State agricultural society speaks as follows of the importance of cultivating forest trees:

First among the wants of this great State, with all its grand possessions and possibilities, is some stimulus to the cultivation of forest trees. If there were artificial groves of ash, oak, walnut, hickory, and the hard woods indigenous to the soil, and hundreds of acres of the evergreens that grow as readily as maple; if the land-owner and cultivator would supply the increasing demand for good, sound, reliable timber, the State would save millions of dollars annually in the matter of farm implements and machinery alone; our people would economize, not only in the prime cost of the article, not only in the first exchange of the money from the pocket of the farmer to the till of the manufacturer, but incalculably more in the enhanced price of farm lands and improvements, the products of the field, and everything he has to sell, by bringing the factory to his own door.

MAINE.

The fifteenth annual report of the secretary of the Maine Board of Agriculture for 1870 contains articles on agricultural organizations and industrial fairs, farmers' clubs as educational institutions, our homes, the grass-crop, distribution of rains, chemistry of feeding animals, country roads, how to attain success in farming, plows and plowing, law for the farmer, associated dairying, preparing milk for market, water as an agricultural agent, fruit-culture, sheep-husbandry, effects of destruction of forests, foot and mouth disease, discussions on underdraining, cutting and curing hay, report of the farm superintendent of the State College of Agriculture and the Mechanic Arts, and abstracts from the returns of town and county agricultural societies.

Hon. Simon Brown, of Concord, Massachusetts, in an address before the Maine Board of Agriculture on farmers' clubs as educational institutions, urges the importance to farmers of a more thorough knowledge of the first principles of agriculture, and of substituting machinery instead of manual labor in the cultivation of the soil, by which more work will be done, and more leisure given for mental improvement, and for making their homes attractive. These ends cannot be gained by the study of a single science, but by a general knowledge of many. They should begin with the first principles of agriculture and ascend gradually to the more difficult and abstruse questions. They must learn the use of tools and machines which supersede human labor, the names and composition of soils, and the plants adapted to each; the appropriate time for doing certain things, as seeding grass-lands, plowing, pruning, cutting and curing grass and grain crops; the habits of animals upon which their prosperity greatly depends; how to plant and cultivate fruit trees, replenish forests, and fertilize soils, so that they shall bloom, phœnix-like, in perpetual fertility from their own ashes.

Farmers must also know how to sell as well as to raise crops. He illustrates this subject by the case of two neighbors. Each raised 150 barrels of Baldwin apples, which grew on similar soil, were of the same quality, and sold in the same market during the same month. B. sold his for \$525, and H. got \$375 for his, being \$1 less per barrel than B. received. B. got his extra price by simply knowing how to sell. He made his barrels all alike, of the same height, with flat hoops, washed clean inside and out, and dried in the sun. The apples, when picked from the trees, were assorted into two classes, No. 1 and No. 2, and placed in barrels without heading up. The barrels were covered with old white sail-cloth and thus taken to market. Everything was neat and attractive, and they sold as soon as offered. H. used such barrels as he happened to find, long and short, round-hooped and flat-hooped, clean and dirty; placed the apples in the barrels carelessly, without assorting; threw an old horse-blanket over them, and in this

condition carried them to market. Of course they sold for a reduced price.

Mr. S. L. Goodale, of Saco, secretary of the board of agriculture, cautions farmers against plowing in clover for manure when it is green and the weather hot. He has known several instances in which it has been treated in this way with very injurious effects. In these cases an enormous burden of lodged clover was turned in when green, and in very hot weather. The result was that a rapid fermentation took place, by which the nutrient elements of the clover were dissipated, and the land was not only not benefited but seriously injured. He thinks that, had the clover been allowed to stand a month or six weeks longer, or until the weather had become cooler, the result would have been entirely different.

Mr. M. B. Sears, of Winthrop, had attempted to raise wheat in rotation with clover, by sowing clover in the spring with wheat and turning it under in the fall. With this treatment the wheat-crop deteriorated. He then changed his course, and let the clover grow till the next July, and plowed it in when in full blossom. The wheat still deteriorated. He next tried the experiment of turning it under when it was ripe, and obtained favorable results. From these experiments he concludes that clover should not be plowed in when green, but be allowed to stand until it is ripe. He finds that new manure may be as profitably used on grass-lands as old and fine. It must be spread on in the fall, and by the next spring it will have disappeared from the surface, below the path of the scythe.

Mr. W. Sweet, of South Paris, considers leached ashes the best manure for top-dressing, and that they would be profitable even at 50 cents per bushel. He spread sixteen dollars' worth of ashes on an acre and a half of land, in the fall, which previously produced only 600 pounds of June grass per acre. The next year he cut over a ton to the acre, a large part of which was clover, although scarcely any had been seen before. The second year he got a ton and a half to the acre. He has mowed it for five years, and the last year he got over a ton of good hay to the acre. He has tried barn-yard manure, but has never found it so profitable, in proportion to the cost, as leached ashes. Ashes when leached lose a part of their potash, but retain their carbonates and phosphates. On some soils where potash is not needed they may answer as good a purpose as unleached ashes.

Mr. Lawrence, of Bucksport, makes a compost for top-dressing by mixing one bushel of lime with three bushels of top soil and allowing them to remain till they have become thoroughly united. When ashes cannot be obtained, it forms an excellent substitute, and will answer a better purpose than unleached ashes. If he were attempting to reclaim a piece of swampy or boggy land, he would use caustic lime only, and in large quantity, but as a manure on other lands he would use a small amount.

Mr. J. V. Putnam, of Houlton, had a piece of land containing nine acres, on which he pastured only a cow and horse. He put 150 loads of manure on the surface of five acres of this, and got a good crop of hay the next year. He has mowed it for nine years, and it has yielded a good crop each year. He thinks the idea that we must plow our land to prepare it for grass is erroneous. After it has been once leveled it should not be broken up again, but should be top-dressed if the crop fails.

Rev. J. H. Gurney, of Foxcroft, says the farmers of that town have adopted the practice of keeping their mowing lands in grass as long as

they can keep them in good condition without plowing. They find it cheaper to top-dress, to re-seed, to harrow, to apply ashes, plaster, and other fertilizers, than to plow. They will do almost anything rather than plow, on account of the great expense compared with the benefit derived.

Mr. H. G. Abbott, of Vassalborough, had a mowing field of 40 acres covered with white weed and yellow weed, and the grass very much "killed out." He turned out 10 acres of it for a pasture, on which he placed 50 sheep, and allowed them to feed upon it for two years. In the spring of the third year he mowed it, and obtained the heaviest crop of hay that he had ever grown with any amount of dressing. Timothy and red-top came in, and in some places the clover was so heavy that the mowing-machine could not be used. It has been mowed for several years, and the last year it yielded as heavy a crop as other fields which had been cultivated in the usual way of plowing and manuring. He is of opinion that farmers who do not pasture sheep on their improved land sustain a great loss. The sheep pastured on the foregoing field received no provender, fed upon it from spring till fall, and were in the best condition. Mr. T. S. Gold, secretary of the Connecticut board of agriculture, has also employed sheep with excellent success in eradicating the white daisy, sometimes called white weed, from mowing fields. A field of 5 acres became entirely overrun by this plant. He put his flock of sheep upon it in the spring, and allowed them to remain until the last of June. They swept off the daisies so completely that not one was to be seen. He pursued the same course the next year. Scarcely a daisy has grown in the field since. There is no difficulty in entirely eradicating these plants by sheep. Rag-weed, and most other weeds which infest fields, may be destroyed in the same way. Sheep are especially fond of rag-weed, and, if cut and dried, it forms an admirable fodder for them in winter.

Mr. Z. A. Gilbert, of Greene, advocates deep plowing and thorough pulverization. By deep plowing, the roots of the plants are permitted to extend themselves to great distances in all directions, and to extract nourishment from greater depths. Thorough pulverization enables the soil to absorb the largest amount of manurial substances; to bring them readily in contact with the roots of the plants; to receive the air into its pores, by which the oxygen may unite with the carbon in the soil and form carbonic acid; to carry off the superfluous water more effectually; and to retain the necessary quantity by capillary attraction. It is the basis on which all scientific cultivation depends. The way to increase the manure on the farm is thoroughly to break and pulverize the soil. The pulverization should be performed by the plow when the land is broken. It can be done much better by a plow properly constructed than by a harrow or a cultivator. The harrow and cultivator act only on the surface to the depth of a few inches, while the plow pulverizes the whole furrow. In selecting a plow, attention should be directed to the power to turn the furrow perfectly, to pulverize it thoroughly, and to cut a deep furrow, also to the line of draught, ease of guiding and handling, and to durability. After having selected a plow, skill and judgment are necessary to adjust the team to it in the best manner. In order that the plow may be easily held and drawn through the ground with the least power, the adjustment should be so regulated that the line of draught will pass from the point of attachment to the ring of the yoke, directly through the attachment on the end of the plow-beam to the point of resistance on the mold-board. If the attachment is too far to the right, the plow runs off the land; if too far to the left, it lands too much. If too low, it does not run deep enough; if

too high, it runs too hard on the wheel. Any adjustment, therefore, which brings the plow out of the line of draught increases the difficulty of guiding and drawing it. Mr. Gilbert uses the double plow, sometimes called the Michigan plow. The forward part pares off the sward to the depth of about two inches, and turns it into the bottom of the previous furrow. The hind part follows and lifts the remaining portion, laying it upon the sward just deposited. By the peculiar construction of the mold-board it pulverizes the soil throughout, leaving a mellow and porous seed-bed. Although this plow cuts a deep furrow and pulverizes the soil thoroughly, it is of light draught in consequence of less resistance being offered when the furrow is lifted in two slices than when lifted in one.

Professor M. C. Fernald, of Orono, thinks that forest-trees have a great influence upon the rain-fall in the regions where they are located. In an address before the board of agriculture, he says: "It should be stated, however, in a single brief sentence, that, while forests may not sensibly affect the mean temperature of the globe, or the total quantity of precipitation, they unquestionably do promote the frequency of showers and equalize the distribution of rain through the different seasons." He attributes the influence of trees principally to the cooling effects occasioned by evaporation of moisture from their leaves. As this process is constantly going on in the hot season, the column of atmosphere over the forest is cooler than that over the denuded land. Therefore the rain-clouds, in their passage over the earth, are condensed more rapidly, and sooner formed into rain over the forest, than over naked land. On the other hand, clouds charged with vapor are often dissipated in their passage through the heated atmosphere of the denuded land without parting with the water which they contain. The fact that showers frequently follow the courses of rivers or hover over lakes he explains on the same principle of evaporation. Electrical discharges, as in case of thunder and lightning, he regards as a frequent cause of showers. He says: "Electricity is one form of force, and this force in the atmosphere that has been used up in the electric discharge has been at the expense of heat. Heat and electricity are frequently interchangeable. A force may develop itself as heat which, with slight modifications, may be developed as electricity. Electricity produces heat; heat produces electricity. Now, when there is an electric discharge there is an expenditure of power, heat is used up, a reduction of temperature of the surrounding air results, and rain consequently follows.

Mr. C. H. Granger, of Saco, in a paper read before the Farmers' Club of that place, says:

> We must now mention two or three conditions affecting the formation of rain, or at least its occurrence in certain localities. These are cold and warm radiations from the earth. The warm radiations take place from level and sandy, treeless plains; and, according to the theory which we shall endeavor to prove, there should be but few or no rain-falls upon them. On the other hand, the cold radiations rise from high wooded mountains and heavily wooded plains. According to the theory, again, there should be frequent and abundant rains in these localities. Humboldt thought that the dense woods gave out what he called 'a frigorific or cooling radiation,' which condensed the vaporous clouds.

In proof of this theory of the influence of trees, Mr. Granger instances the case of Valencia, in South America, which was once situated about one mile and a half from a beautiful lake that was surrounded by a dense forest. The trees were cut away, and in course of time the waters receded to a distance of four miles and a half. The trees were

afterward replaced by others, and in about twenty-two years the lake returned to its original boundaries.

In regard to the question whether any lands that are now barren in consequence of want of rain can be reclaimed and rendered fruitful, Professor Fernald is of opinion that some of them may be, if rain-clouds are accustomed to pass over them, but are dissipated in consequence of great heat; but that those over which rain-clouds do not pass, in consequence of mountain barriers or adverse winds, must forever remain a barren waste. Of the latter may be mentioned the desert of Atacama, on the west coast of South America. The Andes, on account of their great height, cause the moisture in the clouds to be condensed and fall in rain and snow on the eastern side. For seven hundred miles along the coast of Peru the region is rainless, "not a drop falling once in a century." The desert regions north of the Himalaya Mountains, in Asia, are in nearly the same condition. The rain-clouds that come up from the Indian Ocean lose all their moisture in rain and snow on their south side, the rain falling in immense quantities, and nothing is left but dry air to pass over them. To reclaim those lands, over which rain-clouds pass, but are dissipated by heat, he would commence by planting forests on their borders, where there is already rain sufficient to induce vegetable growth, and to extend the planting inland as the rain-fall increases.

Hon. T. S. Gold, of Connecticut, gives his process of preparing milk to be carried to the New York market, a distance of one hundred and twenty miles, without injury. When taken from the cows it is strained into tin cans about one foot in diameter, holding forty quarts each. The cans must be kept perfectly sweet and clean by washing and scalding daily, in water containing a small quantity of sal-soda, which is much better than soap. After being washed in this way, they must be dried in the sun all day, being set in a reclining posture with the tops down. When the milk is put in, they must not be filled full, but only to the point where they begin to contract at the top. Being filled in this way, the milk by extending over the whole diameter of the can will be exposed to the air, which will greatly facilitate its cooling. When filled, the cans are placed in a spring so excavated as to allow the cold water to flow around them constantly, and rise on the outside a little above the milk in them. A temperature of 40°, 45°, or 50° is a very desirable one for the summer season, and one of 60° is the highest which can be employed with success. Some allow the milk to cool in this position without stirring, but he prefers to stir it gently until it is cool. In this way the cream is prevented from rising, and evenly mixed with the milk. The spring should be covered by a building to shade the milk, and thus facilitate the cooling. Some milkmen cool the milk by letting it down into a deep well, and others by putting it into an open refrigerator with ice around the cans, but there is no way so good as that of spring-water. When the time has arrived for carrying the milk to market, the cans are filled full, and placed on board the cars, in boxes containing ice, which keeps the milk perfectly cool. After milk has been cured in this manner, it will keep sweet in an ordinary temperature for three or four days.

Abstracts of county returns mention several instances of good yields. Mr. Moses Smith, of Camden, Knox county, is reported to have raised 100 bushels of shelled corn on one acre. It was planted on green sward, deeply plowed, the soil well stirred and heavily manured. He attributes his success largely to deep plowing and thorough pulverization. Mr. Ephraim Hartwell, of Strong, raised 151 bushels of ears of corn on one

acre. Several farmers in Penobscot county raised 300 to 400 bushels of potatoes on an acre. Potatoes form the leading crop of that county. Three hundred and thirty thousand bushels were shipped in 1870, principally of the Orono variety. The price received averaged 75 cents per bushel, amounting to $231,000. Mr. J. E. Shaw, of Hampden, Penobscot county, raised, on one acre, 33 bushels of excellent wheat, of the variety called the Lost Nation. Mr. H. K. Robinson, of Brewer, Penobscot county, raised 30 bushels on one acre. No crop has been reported to the county society less than 20 bushels per acre. Wheat-raising bids fair to become one of the leading crops of the county.

MASSACHUSETTS.

The eighteenth annual report of the Massachusetts Board of Agriculture for 1870 contains articles on the origin and history of the Massachusetts Board of Agriculture, roads and road-making, principles of breeding, markets for the farmer, New England homes, manures, culture of roots and vegetables, fruit-culture, resources of California, nature's mode of distributing plants, report on Massachusetts agricultural college, market-gardening, value of a regular system of farm accounts, use of capital in farming, culture and preservation of fruits, injurious and beneficial insects of Massachusetts, American mania for large farms, decline of New England agriculture, cattle husbandry, women and science, American and European homes, mutual dependence of producing industries, professional education the present want of agriculture, the farmer's advantage, agriculture in Europe, producing beet-sugar, and county reports.

Dr. J. R. Nichols, of Haverhill, in seven years renovated his exhausted or "run-out" farm of 100 acres, by the use of artificial fertilizers without animal manure, to such an extent that he now keeps 18 cows, 5 horses, 3 hogs, and for a portion of the year 1 yoke of oxen. When he purchased the place only 10 tons of hay were cut. In 1870 he raised 50 tons of hay, 200 bushels of corn, 20 bushels of rye, and large quantities of apples, grapes, and other fruits. In accomplishing this result he used 15 tons of ground bones, 100 bushels of unleached ashes, 4 tons of fish-pomace, 2 tons of Peruvian guano, 500 pounds of crude potash, 1 ton of sulphuric acid, (oil of vitriol,) 10 casks of lime, with small quantities of sulphate of magnesia, nitrates of soda and potassa, chloride of sodium, oxide of manganese, sulphate of iron, sulphate of ammonia, &c. Eight tons of bones were made into "farm superphosphate" by grinding them to powder in a mill, and dissolving them in sulphuric acid. Three tons were combined with unleached wood-ashes, and the remaining four tons were used in various ways. The whole cost of renovating the 25 acres of the farm which were cultivated was $790, or about $32 per acre. He thinks the use of barn-yard manure at $10 per cord in place of fertilizers would have cost him twice the sum to bring the land into the same high condition. He reclaimed two acres of peat-meadow by first turning it over with a spade, pulverizing the surface, and then covering it with sand about 3 inches thick, upon which he put a dressing of 2,000 pounds of fine bone-dust and ashes, mixed in equal proportions. He seeded it down with red-top and timothy, and the first year cut 1½ tons of good English hay per acre; the second year 2½ tons, and about the same for each succeeding year. Meadows which are deficient in peat, or are permanently wet and incapable of being drained, cannot be made productive in this way.

Dr. Nichols plowed an acre of unproductive upland in autumn, and the next spring applied 500 pounds of pure fine bone, sown broadcast, and

planted it with corn, putting a handful of farm-made superphosphate in each hill. One hundred and fifty-seven bushels of ears were taken from the field, being equal to about 78 bushels of shelled corn. After the corn was removed, the ground was plowed and dressed with 800 pounds of a mixture of ashes, bone-dust, and refuse salpeter, and sown down with rye and timothy. Thirty-one bushels of excellent rye were raised. The raw bones were prepared for use by steaming them with high-pressure steam for twelve hours in a large iron boiler, after which they were allowed to cool, and having become brittle by the effect of the steam, were easily reduced to powder by grinding in a machine resembling a common buhr-mill. They might be ground in any common mill which will grind gypsum. The rich gelatine extracted from the bones being formed into compost with dry peat and bone-dust, made a most excellent dressing for the grass-lands. Raw bones are worth about $20 per ton, and steaming and grinding cost $10, making the value of a ton of ground bone $30, for which the farmer would have to pay in the market $60.

The doctor has raised on his farm, for five years past, crops of corn, wheat, rye, oats, roots, potatoes, and grasses. From a careful record of expenses and results, he finds that the corn crop has been the most remunerative, and the wheat next. The corn crop may be said never to fail, if reasonable attention is given to it. His crop has never fallen below 70 bushels of shelled corn per acre, and in 1869 he raised 106 bushels on an acre, in the short space of about one hundred days. The cost of raising his corn in the aggregate has not exceeded 45 cents per bushel. To grow it profitably, a large quantity must be raised per acre. Large crops can be grown with fertilizers containing phosphoric acid, potash, and lime. He used for several years a manure composed of lime, potash, or ashes, and flour of bone; and his crops were excellent. Since he has raised cattle he spreads on the plowed land four cords of good barn-yard manure to an acre, and harrows it in with a heavy harrow. In the hills he puts a handful of a mixture of fine bone and ashes, and rarely fails to raise a heavy crop. He thinks that 20 per cent. more corn can be raised from the same land when well pulverized than when it is coarse and lumpy. Therefore he always plows his ground in the fall, that it may be disintegrated by the winter frost and become perfectly pulverized by the spring plowing and harrowing. It had been a prevalent opinion among the farmers that wheat could not be raised successfully in the town where his farm is located. The first year of making the trial he raised 31 bushels per acre of excellent wheat and sold it for $3.50 per bushel; while his neighbor on the other side of the fence raised only 15 bushels per acre of barley and and sold it for $1.40 per bushel—difference in value of crops, $87.50. To raise this crop, he supplied the soil with the elements needed for wheat growth, which had been extracted from, or had never been contained in it. He prepares the land as for corn, and sows broadcast on an acre 500 pounds of farm superphosphate, mixed with 100 pounds of crude nitrate of potassa, or with 150 pounds of nitrate of soda, and 50 pounds of sulphate of magnesia. The use of magnesia has generally been overlooked, but as about one-eighth of the ash of wheat is composed of this substance, he regards it of great importance, especially on granitic soils. Well-fed, vigorously growing wheat is not usually affected with mildew or other diseases. As bones must be ground to an impalpable powder to be fitted for plant-nutriment, or to be dissolved to any practical extent in sulphuric acid, the best course to be pursued by the farmer who has a quantity of bones which he wishes to use for manure, is to dissolve them by packing in ashes, in

which they will dissolve in a few months if the ashes are kept wet, or by burning them to whiteness in the fire, and then grinding them in a common plaster-mill. The powder being dissolved in sulphuric acid, makes an excellent superphosphate. Bones piled in a heap, with dry wood, will burn very freely when the wood is ignited.

He considers unleached wood ashes far superior, in nutrient qualities, to those which have been leached. One bushel of the former is worth three of the latter on most lands to which they are applied. Their value depends principally upon the potash and soda which they contain, and these are nearly all extracted by leaching. The other salts remaining are insoluble in water, and of comparatively little value. Leached ashes will sometimes have a good effect for a year or two, but the little nutriment left in them will soon be exhausted. Unleached ashes will exert an influence for many years. Coal ashes are but little better than sand, as they contain only about 5 per cent. of soluble matter. They may, however, be used with some advantage, especially on low lands, in disintegrating and lightening the compact soil. He has used horn-shavings, after being rotted, with very good results. They contain a large quantity of nitrogen, and will make a magnificent crop of wheat or corn, but will not produce a plump seed without the use of bone. From experiments made on his own farm, the doctor says that this point has been clearly established: that, in order to grow crops successfully, all the substances needed by the plants cultivated must be present in the soil in which they flourish; and it is his belief that run-down land can be renovated and kept in good condition for any length of time by chemical fertilizers, at less expense than by excrementitious animal manures.

William S. Clark, president of the Agricultural College, says that the contradictory views which prevail in regard to the value of muck as a fertilizer, may be harmonized by the application of science. One farmer declares that he has grown rich simply by the liberal application of muck to his farm. Another asserts that he has tried muck on his land, and found it worthless. A third says that he has nearly ruined his farm by its use. Although different kinds of muck are usually much alike in their general aspect, their chemical composition is often very different. In one case the muck may have originated from the decay of a mass of forest-leaves only, and must, of course, be very rich. In another, it may have been formed from the decomposition of mosses and sedges, which contain elements of much less value; or it may consist largely of sand, and, therefore, be comparatively worthless. In the third case it may be impregnated with protoxide of iron, which is a deadly poison to vegetation. All muck should not, therefore, be discarded at once, but its elements should be ascertained, and a fair trial be made before it is condemned.

Mr. J. J. H. Gregory, of Marblehead, describes the soils adapted to the cultivation of roots and vegetables. The turnip will grow on all the varieties of soil, from sand down through muck and clay; but the English flat turnip succeeds best on a sandy soil, and the ruta-baga on a heavy one. Beets and and mangolds will grow on a sandy loam down to clay, but they are sweeter when grown on a lighter soil. The soil best adapted to them is a rather heavy loam. As a general rule with all vegetables, the lighter the soil adapted to their growth the sweeter the product. The parsnip will succeed on all varieties of heavy soil down to that of muck, but will not thrive on light soil. Carrots will thrive in a great variety of soils, from sand to muck. On sand they are long, regular, and handsome; but on muck, if the season is dry, they

will be very forked. On rocky land they are also likely to be forked. Onions are very select in their choice of soil. They will not succeed on sand, and on clay they grow the whole year and do nothing. The only proper soil is a medium one, neither very light nor very heavy—a gravelly loam. New ground, or land freshly broken, is not suitable for the cultivation of vegetables, except carrots and ruta-bagas. These do very well if the soil is free from witch-grass, (*Triticum repens*,) and deeply cultivated. Other vegetables succeed best when planted the third year after the land is broken. The soil should always be very finely pulverized.

The amount of manure per acre to be applied annually for each of these crops is very large. For beets, on Massachusetts land, about six cords are necessary; for turnips, four to eight cords; ruta-bagas require eight cords; carrots, eight to ten cords; onions, twelve to twenty cords. This, as a general rule, is about the quantity for each of these crops; though it will of course vary somewhat, according to the condition and natural quality of the land. The manure should be applied in the form of a thoroughly decomposed and fine compost, made of muck or clay which has been exposed to the action of frost, night-soil, sea-weed, and barn-yard manure. The compost heap is formed by making a bed of muck eighteen inches or two feet deep, and throwing up a single ridge of muck around it four feet high. Into this cavity put one third as much night-soil as there is muck in the heap, and add a quantity of sea-weed and barnyard manure, such as may be convenient. In the spring, as soon as the frost is out sufficiently, pitch over the heap and mix the materials. In about ten days pitch it over again; and, after a proper interval, a third time if an opportunity is afforded. By this process a fermentation will take place, and the compost will become finely comminuted. This is the kind of manure applied at the rate per acre named above. Ashes and guano are also used as manures. A compost is sometimes formed by making a layer of muck or clay, and then adding to this a layer of fish-pomace about one-fourth as thick as the muck, and mixing them after fermentation has taken place.

The ground for bed-crops is usually plowed in the fall and again in the spring, and worked up very fine, after which the manure is applied and plowed under in very narrow and shallow furrows with a one-horse plow. The ground is then smoothed with rakes. If guano or phosphates are used, they are applied before raking. Mr. Gregory uses four pounds of onion-seed, four pounds of beet-seed, one pound and a half of carrot-seed, and one pound of turnip-seed to an acre, respectively. Three pounds of onion-seed used to be considered sufficient, but he now thinks four pounds are none too much. A good crop of carrots is 20 tons to an acre; of mangolds, 25 tons; of onions, 500 bushels, but sometimes it is nearly double this. Carrots usually sell for about $12 per ton, and onions for $1.25 per bushel.

The squash requires a warm location, warm soil, and manures containing a large quantity of nitrogen, such as night-soil, guano, and hen-manure. Phosphates are also good. The compost manure may be spread broadcast, and the guano, hen-manure, and phosphates put into the hill. Sea-weed is not adapted to squashes. They require eight to ten cords of barn-yard or compost manure per acre. In planting, hills should not be excavated, but the seeds should be dropped on the surface, a handful of guano or other manure being spread over a circle of about eighteen inches in diameter, and then turned under with a fork. When this operation has been performed, the fork is placed in the middle of the hill and twisted, which makes sufficient excavation for the seeds. Six seeds are put in the hill, and finally thinned out to two.

The Hubbard is the best winter squash, and the Turban the best fall squash. Six tons of the Hubbard to an acre constitute a good crop. The Hubbard sells for about $80 per ton; the Turban for $100.

It has been thought that the cabbage, in order to succeed, requires heavy clay or wet land. This is not true. Any land which is good for corn is good for the cabbage. The Winningstadt will grow even on sandy soil. The cabbage is a great feeder, and, like the squash, requires manures abounding in nitrogen. For a first-class crop twelve cords of barn-yard or compost manure are required to an acre, besides guano and phosphates or similar manures in the hill. The Stonemason is the best variety for the standard market crop. The Green Globe Savoy is the standard for Savoys. For early cabbages Mr. Gregory grows the Wyman, Jersey Wakefield, and Winningstadt. Four thousand to twelve thousand may be grown upon an acre, depending upon the distance they are apart. It will generally cost about $150 to grow an acre of cabbages.

Mr. J. F. C. Hyde, of Newton, who has made fruit trees a study for a large portion of his life, is of opinion that there is no fruit so important and so generally consumed as the apple. The idea which has prevailed for some years in Massachusetts, that the State cannot compete successfully in apple-growing with New York and the States farther west, is a great error. All things considered, apples grown in Massachusetts are equal to any raised in the United States. They do not grow to so large size as in some of the more western and southern States, but they are superior in flavor. Apple trees may be grown as easily as oak trees. If land is too costly near cities to be planted with them, it should be purchased at a distance, where it can be obtained at less cost. The apple-crop is one of the surest that can be cultivated. In localities well selected and with common culture, it will not fail once in ten years. He has not known a season for forty years when he has not had apples in his orchard. With the exception of market-gardening and the raising of small fruits near cities, apple-culture is one of the most profitable branches of farming pursued at the present time. He enriches his orchards by spreading manure on the land in liberal quantity, where the trees are small, and also puts three or four wheelbarrow-loads around the base of the trees in the fall, which he allows to remain through the winter. The manure, which should be well decomposed and free from straw and corroding substances, serves to protect the trees from frost and mice, as well as to enrich the soil. The next spring he spreads this manure broadcast on the land, and plows it in with a shoal furrow, so as not to disturb the roots. One of the most valuable manures he has ever employed is wood ashes spread on the ground, but not piled against the trees. He has also used bone-dust with the best results, but its high price has prevented him from employing it so extensively as he desired. It is a good plan to mulch trees with meadow hay, straw, or other similar substances, in order to keep the ground loose and moist.

To succeed in apple-culture, the most profitable varieties should be selected, as the Baldwin, Hubbardston Nonsuch, Roxbury Russet, Porter, Williams, Gravenstein, &c. He advises farmers living near a city, and having old trees which they want to graft, to put in the Williams apple, one of the handsomest and most salable known; and the Gravenstein, which is of the finest quality, and very handsome. The Williams should always be allowed to ripen on the tree. He has seen it sold for $6 per bushel. It will bring $2.50 to $3 per bushel at any time. Both of these varieties may be gotten into market before any of the Western apples arrive. In answer to the objection to apple-culture,

that in the bearing years, when there is a good crop, apples will not bring anything, he says that he has Baldwin trees which bear most abundantly in the odd or non-bearing years, and he has propagated extensively from these trees. His crop of Baldwins is as good in non-bearing years as most farmers' in the bearing years. In respect to changing the bearing year, he says he had a crab-apple tree from which all the fruit was stripped at the beginning of the season of the bearing year. It had time, therefore, to get a start or to gain strength during that year, and the next or non-bearing year, bore abundantly, and has continued to do so ever since. Trees would not always be affected in this way, and, although it might be well to make the trial, he does not think it would, in general, pay to attempt to change the bearing year. The most effective preventive to the ravages of the canker-worm is to put around the body of the tree in early spring, before the frost is out of the ground, a little trough of sheet-iron or lead, filled with kerosene oil, and bent over so as to make a little shed above it, to prevent the rain and leaves from getting in. It is sure death to the worms if they attempt to cross it, and none ever cross unless they are so numerous as to pile in, hundreds on hundreds, and form a bridge over which some can go. He has seen half a hatful on a tree within two feet space, but, notwithstanding the numbers, they can be successfully resisted in this way.

Professor James Law, of Cornell University, in an address before the Massachusetts Board of Agriculture, lays down the following important principles for breeding animals:

1. A perfect development, and sound, vigorous health, constitutionally, especially in the generative organs, are conditions of fertility.

2. In the maintenance and improvement of a breed, the truth that "like produces like"—that the reproductive germ will stamp upon the animal developed from it the characters of the parent organism, is the back-bone of success.

3. We can, in a great degree, at will, produce variations and improvements in breeds, as by abundant feeding, a mild and salubrious climate, a rich and healthy soil, moderate use, education, stimulation, or selection of desirable qualities; by disuse or rejection of undesirable characters and properties; by soliciting the weight of imagination in our favor; by allowing the breeding animals to mix only with those of the stamp desired; by crossing less-improved breeds systematically with males of a better race; and by crossing animals faulty or deficient in some particular point with others in which this point is developed in excess.

4. The herding of pregnant high-class animals with low-bred ones, and the resulting attachments between the two races, are to be especially avoided, as occasionally affecting the progeny injuriously; strong impressions from a new or unusual condition of surrounding objects are to be equally guarded against.

5. If a valuable female is allowed to breed to an inferior male, she cannot be relied upon to produce pure-bred animals for several succeeding pregnancies. Through a strong and retained impression; through the absorption into the system of living particles (germinal matter) from the fetus; or through some influence during pregnancy on the ova, then being most actively developed, the good or bad features of the first sire are perpetuated in the progeny of succeeding ones.

6. All breeds show a tendency to "breed back," or to produce offspring bearing the marks of their less improved and comparatively valueless ancestors; hence individuals of this kind must be rejected from the best breeds, if we would maintain their excellence.

7. Certain races and individuals have their characters more fixed, and will transmit and perpetuate them in greater proportion than others with which they may be crossed. If their qualities are desirable, they prove highly valuable in raising other stock of greater excellence; if undesirable, they will depreciate the value of any stock crossed for many generations. That fixity of type, however, is, above all, a characteristic of those races which have been carefully selected and bred up to a certain standard for many generations, so that in our best, longest established, and most esteemed breeds we have a most valuable legacy left us by the successful breeders of the past, with which we may mold our inferior races almost at will.

8. While breeding continuously from the nearest relations tends to a weakened constitution, the aggravation of any taint in the blood, and to sterility, these may be avoided by infusing at intervals fresh blood of the same family, but which has been bred apart from this branch of it for several generations. Moreover, the highest excellence is sometimes attainable only by breeding very closely for a time.

9. Diseased or mutilated animals are generally to be discarded from breeding. Mutilations resulting from disease, disease existing during pregnancy, and disease with a constitutional morbid taint, are, above all, to be dreaded as transmissible.

10. There is some foundation for the opinion that the sire tends to contribute more to the locomotion and external organs, nerve, and vigor, and the dam to the size and internal organs, so that if we cannot obtain the greatest excellence in both, we should at least seek to have each unexceptionable in the parts and qualities attributed to it.

Report of 1871.—The nineteenth annual report of the secretary, for 1871–'72 has been received, in advance sheets, at an earlier date than usual. The volume evinces great care in the choice of material and in its general preparation. Mr. C. L. Flint, the secretary, brings to his work a large understanding of agricultural interests and enthusiasm in efforts for their promotion. In presenting the reports to the legislature, the secretary urges the great importance to the State of grass and hay crops. He asks why grass-seeds, which are costly, should not have an equal chance for life and strength of growth with other and less expensive seeds? He maintains that early fall seeding, without grain, is preferable to seeding in spring, and that there should be no grain crop immediately preceding the seeding-down of grass, this being the ultimate and paying crop. If spring grain is sown, it is more economical to sow it alone, plow up the stubble, and sow the grass-seed alone early in the fall. In preparing seed for mowing lots, varieties should be mixed which blossom at or near the same time. The general adoption of these plain suggestions would materially promote the agricultural interests of the State.

At a public meeting of the board, Dr. Nathan Durfee, of Bristol County, urging the importance of increasing the products of the soil, states:

> From it we receive our daily bread. And yet what encouragement is held out to that man who, by constant toil, is now producing four tons of hay where formerly scarcely one was received? Or what credit would that man receive who, from apparantly worthless and cast-off land, covered with rocks, snags, and tussocks, should present to your view a beautiful meadow of twenty acres, destined ere long to produce fifty tons of hay? And does it not speak well for the progress of agricultural science that, in our county, one man can testify that within the period of twenty years more than forty acres of swampy, rocky land, hardly worth the name of an owner, have been brought into successful cultivation?

At the same meeting Mr. George E. Waring, jr., of Rhode Island,

maintained that the best way to teach New England farmers the advantages of more thorough cultivation is by example; and one of the most important is that of a perfectly good seeding-down of land to grass. Land that will produce two and a half tons of hay to the acre is worth almost any amount of labor, or care, or money that it may have cost. In preparing land for the best results, he believes that draining is the first thing to be considered, and that the importance of underdraining is greatly underrated, not only in New England but throughout the country. As between tile and stone draining, he is decidedly in favor of the former; but does not think it would pay a farmer to drain a single acre, if he does not need that acre—if he has another acre that he can make pay better than it now does by spending the money on that.

In raising grass, Mr. Allis, of Franklin County, has the best success after tobacco. During an experience of twelve years, he has not found any deterioration of his land. His practice is to raise tobacco two years in succession, and then seed down to grass. His crops of hay are large, and of excellent quality.

Prof. P. A. Chadbourne, with a view to show what great results may be accomplished by patient industry, even on the most inhospitable lands, refers to the fact that, twenty-four years ago, the original settlers of Utah first reached the Salt Lake Valley in the greatest poverty. They went down into the lowlands and dug thistle-roots, month after month, to live upon. But now the whole valley teems with flocks, and abounds with corn and as fine fruits as grow anywhere—all prepared beforehand for those mines that are now opening up with such richness all through those mountains.

Dr. James R. Nichols discusses the food of plants and sources of its supply. He aims to point out the chemical nature of the materials required by various plants, and the best methods of obtaining these materials with reference to stimulating plant-growth. In his opinion, when cultivators have acquired proper information, the accumulation and use of these materials will be as simple as is the supplying of raw materials for making cloth, boots, and shoes, or any other manufactures. During the past nine years he has endeavored, on a farm in Essex county, to show that fields can be fertilized and brought into good tilth by the use of the agents holding plant-food wholly exclusive of animal manures. He finds that each successive crop affords additional proof in favor of using chemical or manufactured fertilizers. He has raised 3 tons of hay and 300 bushels of potatoes to the acre upon fields to which not a pound of animal manures had ever been applied. Corn also succeeded remarkably well. Dr. Nichols denounces the frauds of dealers in manufactured fertilizers. Their profits are enormous, and their wares not always what they are claimed to be. He says—

> After much observation and thought upon the subject, I have reached the conclusion that it is difficult, if not impossible, for manufacturers to supply in a large way, through the ordinary channels of trade, superphosphate, or any compounded fertilizer, so as to give the farmer a just return for his money. The reasons for this conclusion are that the elements of plant nutrition, or the three most important agents which should enter into fertilizing compounds—phosphoric acid, potash, and nitrogenous bodies—have a fixed market value, and the difference in price between their purchase, in moderate or large quantities, is not great enough to give to large manufacturers an advantage worthy the attention of honest men.

He presents a formula for a compounded fertilizer, easily prepared, which he has found of the highest value. He has used bone-charcoal from the sugar-refineries as a cheap source of phosphoric acid, but states that burned bones may be used instead, with fully as good results. The formula follows:

> Take 900 pounds of bone-charcoal, 486 pounds of oil of vitriol, and 171 pounds of

water; mix the water with the acid, and gradually add the bones, stirring the mass that it may be fully acted upon. This affords a superphosphate which is dry enough to be ground as soon as it is cool, and it can be ground in a plaster-mill. To this add 400 pounds of nitrate of soda, 100 pounds of muriate of potash in powder, and we have a ton of fertilizing material, which I have found, upon analysis, gives 14.39 parts in the 100 of soluble phosphoric acid, 27.47 parts of soluble phosphate of lime, 2.8 of potassa, 3.14 of nitrogen. * * * * * The cost of materials, at present market rates, will be about $44.

The importance of growing farm and garden vegetables, both with reference to profit and home consumption, is discussed in an address of Mr. R. Goodman, of Lenox, and with the following conclusions: It is too much the custom of farmers to raise common vegetables for market, when a greater profit might be realized by more care in selecting choice varieties and seeds of the best quality, and in cultivating in the best manner. Again, even the products raised are too little used at *home.* There is too much "hog and hominy;" too much meat in the diet of the farmer—pork especially. More fruit and a larger variety of vegetables ought to be used. As to meat, a two-year-old steer can be raised at no greater cost than a hog. Packing the beef in a barrel, the farmer will have a better quality of meat; at all events, will diversify the food of his family, "and if he adds the vegetables which ought to be grown in his garden, his family will improve in health and in morals." It is stated that scarcely a farmer's garden at a distance from city markets could be found in Massachusetts, in which there is asparagus, or cauliflower, or celery, or egg-plant. If these and other vegetables are a luxury, it is surprising that farmers do not have them for their own use, to say nothing about raising them for the market.

Mr. Ellsworth, of Essex County, furnishes an interesting paper on the "Management of the Dairy." Referring to the progress made in securing for the dairy the best breeds, he represents that the former large herds of scrubby native stock, without pedigree, are now superseded by grades and pure-bred cattle showing distinctly their descent from animals of marked and well-developed characteristics. Without animals carefully bred with reference to his pursuit, the dairyman cannot attain the highest success. Mr. Ellsworth calls special attention to the *care* which should be given to the animals of the dairy, stating that a cow about to drop her calf should be placed in a comfortable stable, well protected against draughts, with plenty of bedding, and her condition looked after every hour until she calves. Immediately after, a pailful of water, slightly warm, with a pint of rye-meal stirred in, should be given her; and she should have water of like temperature often, but never more than a pailful at once, and only a small quantity of fodder for the first twenty-four hours. No grain for four days or a week, but a few roots are beneficial. In order to satisfy himself as to the proper time for milk to stand before skimming, he made two trials, of a week each, in the month of December, with the following results:

During the first week the milk was allowed to stand thirty-six hours. The amount of milk for the week was 1,493 pounds, or 678 quarts—$2\frac{1}{6}$ pounds to the quart. From this milk 69 pounds of butter were made, or an average of 1 pound of butter for every $9\frac{5}{8}$ quarts of milk. The second week the milk was allowed to stand but twenty-four hours, and the following was obtained: The milk weighed 1,296 pounds and measured $589\frac{1}{2}$ quarts, and from this amount 51 pounds of butter were made, $11\frac{1}{2}$ quarts of milk being required to make a pound of butter. Thus we cannot afford to skim the milk in twenty-four hours, when the weather is favorable for butter-making, unless it is our intention to make cheese at the same time. As a general rule, thirty-six hours seems to be, under all circumstances, the proper time for milk to remain before skimming.

Mr. Ben. Perley Poore, chairman of the Essex County Agricultural Society, reports that on the farm of Mr. Daniel F. Appleton, of Ipswich,

only six tons of English hay and twenty-five tons of fresh meadow hay were cut five years ago; but the present year it produced seventy-five tons of English hay and two or three tons of fresh meadow hay. This result was produced principally by draining. He first had the low grounds of his farm surveyed, the levels taken, and a broad ditch more than a mile long, and, on an average, three feet deep, dug through them, with a sufficient fall to carry off the water received from the smaller lateral ditches and under-drains. By this main ditch he is enabled to drain all the meadows through which it passes. He surrounded ten acres of this land with a catch-water ditch, eighteen inches deep, leading, at long intervals, into the main ditch. This meadow had been kept constantly wet by water from springs which surrounded it; but by this plan it was so thoroughly drained that the most of it was easily plowed and laid down to grass. A part of it was plowed for the first time in the fall of 1870, and in December following was sown with timothy. After being sown it was top-dressed with a compost of loam, mixed with ashes at the rate of thirty bushels to an acre, and a small quantity of manure. The next season it yielded two to two and a half tons of English hay per acre. Three acres also of the same meadow were a deep muck-bed, and could not be brought into a condition to be worked at the time of plowing the other portions. Mr. Appleton covered it with gravel in the winter, and in the spring sowed it with timothy. No crop of grass, however, was raised worth cutting that year. In the fall it was heavily top-dressed with barn-yard manure and thirty bushels of unleached ashes to an acre. The next two seasons he cut over three tons to the acre of the best quality of hay. By this experiment he learned the value of muck-land when mixed with upland soil, whether gravel, sand, or loam. In reclaiming some mucky lands, he has found that draining, plowing, and top-dressing with ashes will be sufficient without the application of loam or sand; and in other cases a very light application of the latter is all that is needed. Thirteen acres of swamp-land, which were covered with tussocks and pond-holes, were thoroughly drained with round tiles and collars, the drains being thirty-three feet apart, and three to four feet deep. The land was drained without the aid of the encircling catch-water ditch, and yielded sixty bushels of corn to an acre. Having been top-dressed with ashes and bone-dust, it was sown the next year with wheat and grass, and yielded a heavy crop of the former. Mr. Appleton thinks highly of the plan of reclaiming swamp-lands by draining and top-dressing, and regards them as the main future dependence of the farmers of New England for supplies of hay.

Mr. Ephraim Graham, of Worcester County, remarks that grass, when made into hay, contains 14 to 15 per cent. of water; in the green state, some 80 per cent. The dry part contains, besides its nutritious substances, as gum, sugar, and oil, about 50 per cent. of woody fiber. The time of cutting grass has much to do with the nutritious value of hay. When the leaves and stems are green they contain large quantities of sugar, gum, &c., a part of which is changed into woody fiber as they ripen. Hence they lose a large portion of their nutritious qualities when not cut before ripening. What has been said of early-cut hay will apply to the straw of grain and to corn-stalks. If they are cut ten days before the grain is fully ripe, their quality for feeding is much better than if cut later. Careful experiments have shown, also, that wheat cut twelve to fourteen days before being fully ripe weighs heavier, measures more, is of better quality, and yields a larger proportion of flour. When the kernel is in the milk it has, comparatively, a small

amount of woody fiber, nearly the whole being gum, sugar, and starch, with a large per cent. of water. As the grain ripens, the thickness of the skin rapidly increases, at the expense of the sugar and gum. The quantity of flour, therefore, is diminished, and the quality injured. What is true of wheat is probably true of other grains. But grain raised for seed should be fully ripe before harvesting.

In regard to draining, Mr. J. W. Adams, of Hampden County, thinks it a mistake to leave the ground loose about the tiles, in order that the water may find its way into the drain. To put clay against them, and then fill up the whole drain, as if to keep the water out, is the true way. In all successful underdraining, the water must enter the drain from the bottom. When hired labor is employed, it is recommended to pay for ditching by the rod. A man will dig nine rods, three feet deep, in a day, with common tile-ditching tools. At the outlets of drains he uses strips of boards, three or four inches wide, and uses the same nailed together in the form of a triangle, as tiles, in locations where tiles are liable to be displaced. He claims that tiles are cheaper than stones for draining, even when the latter are found in the field; that land which needs underdraining is the best and cheapest in New England; that when such land is underdrained thoroughly, there is no perceptible difference between the yields of dry and wet seasons; that it requires less manure, and is warmer; that the air penetrates it more readily, and decomposes the organic matter more easily for the food of plants; that it is always ready for a heavy rain, since the surplus water, to the depth of three feet, is taken out; and that for raising maximum crops of hay, vegetables, or fruit, it is a safe investment, and, in his own experience, the cost has not exceeded the compensation.

MICHIGAN.

The ninth annual report of the State board of agriculture is a carefully prepared document, embracing, besides valuable essays on well-chosen subjects and the usual statistics, full reports of the proceedings of the recently organized State Pomological Society. During the year, the secretary of the State board, Hon. Sanford Howard, who was also for a long time closely connected with the agriculture college of the State, was suddenly stricken down in the midst of his labors. Mr. Howard was distinguished for his zeal in the promotion of agricultural progress. A native of Massachusetts, at an early age he engaged in farming pursuits in Maine, subsequently removed to Ohio, and afterwards to Michigan. During the last thirty years of his life he was more or less intimately associated with the agricultural publications of the country; was at all times prepared to give to the farming community the benefit of his enlarged experience. By a prominent journal he is ranked among the pioneers of agricultural literature in this country. The present report, published after his demise, shows in its preparation that conscientious care and intelligence for which he was so prominently known in matters pertaining to rural husbandry.

The report contains a number of elaborately tabulated results of experiments in pig-feeding during the year; also of experiments with manures and special fertilizers, and in tomato cultivation. These experiments are reported with so much particularity and minuteness that they cannot be reproduced in the limited space to which our notices of State reports must necessarily be confined. Three years of testing manure application leads to the statement that the manner in which manure is applied apparently makes but little difference in the end. That applied to the surface appears to give quicker results, while that

plowed under seems to act slowly, giving the best return in subsequent crops.

In a lecture on pastures delivered before the Central Farmers' Club, Professor Coleman stated that the following may be taken as a proper average mixture of grass-seeds: 5 pounds rape, 5 pounds cow-grass, (perennial red clover,) 5 pounds white clover, 2 pounds red clover, 2 pounds Alsike clover, 2 pounds meadow foxtail, 1 pound crested dogs-tail, 2 quarts meadow-fescue, 8 quarts Italian rye-grass, 8 quarts Pacey's rye-grass, 8 quarts Stickney's rye-grass, 2 quarts cocksfoot, (orchard-grass)—to be sown latter end of May and beginning of June. The rape affords shelter to the young herbage, and the additional feed to the sheep occupying the pasture the first year gives increased droppings on the land, and greater fertility.

Mr. John Richard, of Tecumseh, considers that the cultivation of sorghum for production of sirup is permanently established in the State, and that it is the most profitable crop that can be grown, where it is properly managed. In the season of 1870, on a little less than an acre of ground, he raised 200 gallons of sirup, which sold readily at 75 cents per gallon, netting a clear profit of $75. No other crop on his farm paid as well. Mr. Tafft, of Plymouth, says that more attention was given to the cultivation of sorghum in 1870 than for several previous years, the acreage being double that of the year before, and the yield per acre also about double. He says:

> The fact is now established that our soil and climate are favorable to the growth and even the *improvement* of the sorghum plant. We must have more and cheaper sugar (or its substitute) from some source, and our hopes center on the beet or the sorghum plant. There are difficulties to be overcome in establishing the manufacture of sugar successfully in any country. * * * * I see a great improvement in the handling of the cane, a better understanding as to the requirements of the plant and the manufacture of the sirup. The novelty has died away; sorghum stands now on its merits; the increase in its production will be slow, but lasting and substantial.

Mr. Milton J. Gard, in an essay on general farm-management, gives his method as to crop-rotation on prairie soil, a method yielding good results:

> First clover, followed by wheat, with but once plowing, in August; then corn, which is also seeded to wheat, and seeded to clover in the following spring. All the manure made is applied on the wheat-stubble in the fall or winter, and spread as drawn, for the corn-crop. My land is seeded and partly manured every fourth year, and for each seeding I get three grain-crops—two of wheat and one of corn. But when wheat fails to bring such high prices as at present, I change the course to two of grain and to one of clover. I consider the best mode of renovating and keeping up the fertility of the soil is the use of clover and plaster. There is no investment that pays me so well as plaster sown on clover at the rate of fifty pounds to the acre; and I believe that the fertility of our farms can be kept up by a judicious rotation of crops, and by carefully husbanding all the manure made on the farm, with no other foreign fertilizer.

The same writer, in an essay on the breeding and management of hogs, considers pork-raising the most profitable of any one branch of agriculture, requiring the least care, labor, and capital. The pig grows into money, and while growing he is converting our grass and clover into suitable food for our wheat-crop, and into meat and lard. He contends that it is more profitable than wheat-raising, because, instead of exhausting the fertility of the soil, it enriches it, and is more certain in its results, having fewer enemies to contend with. "In the pork crop there is no risk of smut, midge, rust, or mildew, blight, winter-killing, lodging, or by being beaten down by hail-storms, or sprouted by wet weather at harvest time." In view of the very considerable profits of the middle-men, which lighten the pockets of producers, Mr. Gard

advises farmers to ship and sell their own hogs. If one farmer has not a car-load, let two or more join and make up a load and ship them. Mr. Beckwith, president of the State Agricultural Society, is of the opinion that no kind of stock kept by the farmers of Michigan shows so marked an improvement within the last twenty years as swine, and considers the pork of Southern Michigan as second in point of value to no single commodity put into the markets by its farmers. Referring to the alleged fact that during the year combinations had been organized for the purpose of purchasing or controlling certain leading farm products in some of the States of the North and West, at prices below their real value, Mr. Beckwith counsels farmers to form counter combinations, with a view to control, when practicable, not only the prices of farm products, but the time of sale and manner of transportation. He suggests that they meet in their respective neighborhoods and discuss the subject, in order to mature a definite plan to circumvent the arrangements of those who seek to buy without rendering a fair equivalent.

The annual report of the secretary of the State Agricultural Society shows that the organization is making substantial progress. The total receipts for the year, including balance due treasurer, were $15,913.95. Amount of premiums paid, $7,389.70, against $6,889 in 1869. The number of entries at the State Fair increased from 1,485 in 1863 to 2,555 in 1870. The property of the society is valued at $18,661.98. The secretary claims that the agriculture of the State is undergoing a gradual change, in many sections becoming of a much higher order. A large proportion of labor and capital is expended in clearing the surface and in reducing unimproved lands to a condition that will fit them to become productive. He says:

> But the interest that has sprung up during the past five years in regard to tile-draining, improved breeds of the domestic animals, especially cattle; implements and machinery that are better adapted for profitable farm-work, and in regard to the production of fruit, is very marked, and ought to be encouraged by every means within the ability of the State Agricultural Society.

The State Pomological Society was organized in February, 1870, at Grand Rapids, and during the year a number of very interesting sessions were held. In September it held its first annual fair, at which there was a very creditable display of fruits and flowers. At the several meetings many important facts and experiments bearing upon the fruit interests of the State were presented.

Rev. H. E. Waring, residing near Grand Rapids, ranks Steele's Red Winter apple and the Rhode Island Greening among his most valuable varieties in full bearing. Making peaches a specialty, he has not failed of a crop for fifteen years, although there have been a few seasons when the yield was not more than one-half or third of a full one. He places the Early and Late Crawford and Barnard at the head of his favorite varieties. Among the dwarf-pear varieties, he says that the Louise Bonne de Jersey has paid twice as much as any other. Mr. Houghtaling thinks that May is the worst, and March the best month for pruning. June is a good month; also April in late seasons. Wax or gum-shellac should be used to prevent bleeding. The same gentleman said that there were thousands of trees in the country that needed to be grafted over to make them worth the ground they occupy or profitable to their owners. He thinks it just as easy to raise the best fruit as to raise the poorest, and has found by experience that it is very easy to put a new top on an apple-tree, even after it is fifteen or twenty years old. His method is to cut off the limbs out as far from the tree as possible, in order to keep the top open and well spread out; to perform the work all at one

time, that the top may make an even growth and be well balanced; to afterward carefully attend to the trees, keeping away all the suckers that take the growth from the graft, and sometimes kill it entirely. Mr. J. P. Thompson, in an address on the "orchard system" obtaining in the famous fruit-belt of Western Michigan, represents that the one great mistake made by those who raise fruit for the market is the planting of too many sorts. He thinks that a small and carefully considered list of the best varieties, sanctioned by trial and experience, ought to be prepared for the guidance of those entering upon or engaged in the pursuit of fruit-culture. In discussing the subject of the popular varieties of hardy apples, W. L. Waring thought that for a small list, to be planted solely with a view of obtaining the largest income from 1,000 trees, 50 each of the Red Astrachan, Duchess of Oldenberg, Cayuga Red Streak, Maiden's Blush, and 200 each of the Baldwin, Wagener, Golden Russet, and Rhode Island Greening, would make a selection that would be found the most productive, reliable, and profitable.

Concerning the planting of strawberries in the speediest manner, Mr. Henry S. Clubb recommends the use of a dibble that will make a hole the size of a fifty-cent piece. The soil being dry, some one should go ahead of the planter, making holes and filling them with water, the planter following, and with another dibble inserting the plants, pressing the earth quickly around the root after the plant is in, care being taken not to cover the eye, which is very near the root. The old root of the plant is useful to hold the plant to the ground; the new fibers become the main support of the growing vine. "Having the plants firmly set is of much more consequence than any theoretical arrangement of the old roots, and this can be secured most readily by one stroke of the dibble on one side of the plant, pressing the earth toward it. * * * * August planting can be made successful in this manner, no matter how dry the season, if careful hoeing and cultivation be attended to." At a meeting of the horticultural society of Black Lake, it was stated that by inclosing strawberries in a dry, closed box, and placing them in an ice-house, they were kept fresh for three weeks, and the party making the statement thought that the same treatment might have kept them good for twelve months. Mr. Clubb supposed that ingenuity would shortly construct safes on this principle, which would render this favorite berry an article of every-day consumption, instead of a luxury of a few summer weeks. This accomplished, the production of strawberries would become as extensive as that of any staple article, and much more profitable.

The reports of county societies made to the State society are generally full, and indicate a progressive interest in all that pertains to improved systems of husbandry. The farmers of Calhoun County are entering upon the system of rotation of crops, including sheep and stock raising, which they discover to be more remunerative than their old manner of farming. More attention is also paid to fruit-raising, including grapes. In Cass County pork is stated to be the most valuable export, and improvements in breeding are being made. The practice of feeding on clover through the season is attended with the very best results. The culture of hops has been almost wholly abandoned in Genesee County, but there is an annually increasing acreage in vineyards. A very important interest in the county of Hillsdale is her cheese factories, of which there are eight, and the industry growing.

MISSOURI.

In the annual report for 1870, the secretary of the State Board of Agri-

culture represents it as having assumed a higher and more advanced position than at any former period. The reports of the county and horticultural societies, and of the entomologist, are full and instructive.

Mr. T. R. Allen, in an address before the board, urges the importance of better education among farmers. He has little hope of any great improvement in the modes of agriculture until those engaged in it become more intelligent. No pursuit in the whole range of human society requires more thorough, extensive, and diversified knowledge of the sciences than that of the agriculturist. He proposes, as one mode of enlightenment, the missionary plan of choosing intelligent and practical agriculturists, and sending them forth to visit farmers and talk with them publicly and privately; to give practical instruction on their farms and at their school-houses; to organize them into clubs and county societies, and induce them to read agricultural books and papers. Dr. H. Claggett, president of the State Horticultural Society, says:

> The people are beginning to learn that every plant we cultivate grows in accordance with natural laws, and requires for its highest development certain conditions; and just so far as we supply these conditions will be the measure of our success. Just so far, then, as we have failed to do this, we have failed both scientifically and practically.

The secretary of the board gives the results of a series of experiments recently made in Germany in reference to the question whether the quality of food fed to cows has any influence on the quality or chemical composition of the milk produced. Dr. Haase, at the agricultural experiment station in Moeckern, Saxony, fed several cows, first, upon hay, which he called normal fodder; secondly, upon hay in connection with bean-meal and rape-cake, which are rich in albumenoids from which the cheese portion of milk is derived; thirdly, upon hay in connection with oil and starch, which contain carbo-hydrates from which the buttery portion of milk is derived. After a careful chemical analysis of the milk produced from the several kinds of food, he found so little difference in the corresponding kinds of milk, that it could not be regarded as of any practical account.

Dr. Kühn, who made several experiments on the same subject, declares that variations in fodder are not manifested in the quality of the milk, but in the quantity only. Professor Wolff, director of the experimental station at Hohenheim, in Würtemberg, who has conducted a long series of investigations on this subject, says the quality of the food exercises no influence on the quality of the butter in the milk, except in the taste; while its influence becomes readily and distinctly manifest in the quantity of milk yielded, and in the increase or decrease of the live weight of the animals. Dr. Kühn suggests that the farmer should look to the peculiarities of different breeds of cows for the milk best adapted to his special purpose. If he desires a large yield of butter or cheese, he must select such as naturally produce milk rich in those substances. If he desires a large quantity of milk without regard to quality, he must choose those which excel in that respect. In Germany, where English, French, and German breeds of cattle have been tried quite thoroughly, the Allgauers, Devons, and Herefords are much liked for butter and cheese making; while the Hollanders are preferred for milk, and the Short-horns for fattening. The Allgauers are small or medium sized, thick-set, and finely built, and consume a small amount of food. Some herds average 2,500 to 2,600 quarts of milk per head yearly. The Hollanders are large and stout-built, often weighing 1,650 to 1,700 pounds, and yielding 4,500 quarts each per year. They require rather high feeding, but are easily fattened. For these reasons the Hollanders are especially adapted to the neighborhoods of large towns, where brewery and distillery refuse and

commercial food, as oil-cakes, are cheap, and fresh milk finds a ready sale. It is thought that the Allgauers and Hollanders deserve more attention among stock-growers in this country than they have received.

Mr. S. B. Johnson, of Madison County, declares, as the result of his experiments with potatoes, that the Early Rose is ten days earlier than the Early Goodrich, or any other variety with which he is acquainted. It is very productive, and good for summer, winter, and spring, and will keep the year round. Early in July, 1870, he had on his table samples of that year's growth and of the preceding year, and they were both pronounced excellent in quality. He recommends that in the cultivation of potatoes care be taken to select sound and well-ripened tubers for planting. This is of more consequence than the size of the tuber. Cut large potatoes into pieces containing one eye only, beginning at the end opposite the stem and cutting toward the center, taking care to leave an equal proportion of the potato with each eye. Very small tubers may be quartered, cutting in the same manner. When cultivated on a large scale, he prefers planting in hills instead of drills, laying the ground off by shallow furrows three and a half feet apart each way, and putting one to three pieces in a hill, as thought most desirable. If the eyes are perfect, as good a crop may be expected from one piece as from three. Cover with a plow or hoe three or four inches deep, and just before or after the plants appear go over the ground with a two-horse harrow. When about three inches in height, run close to the hills each way with a one-horse diamond-plow, to the depth of five to seven inches, throwing the earth from them. When about six inches high throw the soil back to the hills with a larger plow. By this treatment the incrusted surface will be broken, the soil loosened and aerated, and a soft, mellow, and roomy bed made in which the new potatoes may grow. No further stirring of the soil is needed. As soon as the potatoes begin to blossom, the ground should be left undisturbed, as any stirring at this time causes new tubers to set, and, as a consequence, an undue quantity of small potatoes. Should any weeds appear among the hills, pull them up by hand, or cut them down if likely to disturb the earth near the tubers.

Mr. C. W. Fangenroth, of Madison County, after six years' trial, recommends plowing all rolling and flat grounds in large lands of at least ten acres, beginning in the center and turning all the furrows toward that line. In this way the troublesome dead furrow in the center is avoided, hard ground is left to turn the team on, and the earth, instead of being heaped up in a ridge, is thrown away from the outside of the field, and a ditch left around it. He is in favor of plowing all land deep, except very sandy soils or sandy subsoils. Some farmers fail by subsoiling too deep at first, thus bringing up too much new soil. He would subsoil only a few inches the first year, and let the loosened soil remain in the bottom of the furrow instead of bringing it up to the surface.

He says $20 to $100 are expended in England for underdraining an acre of land, yet the improved productiveness richly repays for the expense, and that statistics prove that in wheat alone the average yield of their former undrained ground was only twelve bushels per acre, while at present the same land, which has been underdrained, produces twenty-six bushels. Many of their underdrained meadows yield three to four crops of hay annually. Mr. John Johnson, of New York, the venerable pioneer of underdraining in this country, is fully satisfied that tile-draining usually pays for itself in two years, sometimes in one. He has rented some of his underdrained lands for $25 per acre annually.

Mr. Wallace Sigerson, of Saint Louis, advises to select for the location

of an apple orchard the highest ground in any particular locality; to loosen the soil to the depth of two feet, and underdrain with tiles if it is too wet; to use the very best trees, three years old; to set them near the surface of the ground, thirty-five feet apart; to trim them so that the lower limbs may be six feet from the ground, and to wash them with strong soap-suds, soft-soap, or weak alkali three or four times during the season, beginning with May; to wrap the bodies in November with straw from the ground to the first limbs, and to remove it after the hard frosts in spring; to prune sparingly, only enough to admit the light and a free circulation of the air; to cultivate the ground with corn, potatoes, or vines for the first five years after the trees are planted, and then with red clover; to mulch them every fall with leaves, or with straw and sand, forked into the ground in the spring; to apply lime to the ground in proportion to the benefit derived from the treatment; to surround the orchard with a border of evergreens, four rods wide, as a protection against the winds, the inside row being composed of red cedar and the outside of the Norway spruce or white pine; to allow hogs and poultry to run in the orchard when in clover, and to keep the soil up to its original fertility. If these directions are followed up, the crop of apples the fifth year will pay all the expenses of raising the orchard. He recommends for summer, Early Harvest and Red Astrachan; fall, Pennsylvania Red Streak, Yellow Bellflower, and White Bellflower; Winter Green, Newtown Pippin, Rawle's Janet, Winesap, Pennock's Red Winter, Rome Beauty, and Ben Davis; for family use, without regard to profit, Northern Spy, Esopus Spitzenburgh, White Winter Pearmain, and Jonathan. Mr. G. S. Park, of Parkville, represents the apples of Platte, Clinton, Clay, Ray, Carroll, Jackson, Chariton, Sabine, Lafayette, and Caldwell Counties as being unequaled in size, specific gravity, and flavor. He attributes these high qualities largely to the climate, which is peculiarly modified by the warm, soft, and dry winds that come up from the southern plains from July to October. Those counties, he thinks, must soon command public attention, and take a high position in the horticultural regions of the world. He urges the importance of procuring the most healthy and vigorous stocks to graft upon. Those on which we graft our apples are too often grown from imperfect seeds. The vital principle in a plant, as well as in an animal, continues the same through life, and is strong or weak, according to its original vitality. Diseases of the human family are handed down from father to son for ages. The same laws hold good in fruits. Stocks which are to be grafted upon should be grown from the largest and most perfect seeds taken from the best and most hardy fruit. The Lawver, Missouri Superior, Huntsman's Favorite, Park keepers' Hardwick, Ella Park, General Lyon, and Todd's Sweet are varieties which have been originated in the preceding counties, and are said to be of fine quality and peculiarly adapted to that region. Mr. J. J. Funston reports that 150,000 apple-trees have been set in Ray County within the past two years, and that there are 200,000 in the county now in bearing. The varieties generally planted are the Jeniton, Summer Queen, Carolina June, Fall Wine, Fall Pippin, Yellow Bellflower, Winesap, and White Winter Pearmain. The Jeniton constitutes about one-fifth of the whole number. Within the same period 18,000 pear-trees have been set, which consist principally of the Bartlett, Flemish Beauty, Duchesse d'Angoulême, and Louise Bonne de Jersey.

Mr. O. P. Moran, of Clinton county, has cultivated the Concord grape with excellent success. The soil and climate are so well adapted to grape culture, that almost every one is planting for home use, and many

for the market and wine-making. He planted a Concord vine which came into bearing in 3 years. From this he raised 9 vines in a few years, and sold the fruit grown from them in 1 year for $53. He has now a vineyard of 7 acres planted with this grape, and has gathered 70 pounds from a single vine 5 years from planting. He planted his vines 8 feet by 10, 500 vines to an acre, and allows them to bear, on an average, about 20 pounds to a vine, or 5 tons to an acre. He has raised a number of cross-breeds between the Concord and Catawba, one of which is about the same quality as the Concord, but ripens even earlier than the Hartford Prolific. He has another larger than the Concord and having the color of the Catawba; but it is superior in quality to either of them. Several of them are white, distinct from one another, all rich, sweet, and delicious. There have been set in Ray County, during the past two years, 50,000 grape-vines, almost all of which are of the Concord variety. Mr. G. Harmung estimated that there are more than 100 acres planted with grape vines in Jackson County. They are principally the Concord, Norton's Virginia Seedling, and Hartford Prolific. From 3 acres, 750 gallons of Catawba wine, 400 Concord, and 80 of Norton's Virginia Seedling were made. Mr. Conrad Klinge states that grapes are the main product of Gasconade County. There are 800 acres now in cultivation, from which 200,000 gallons of wine were made, and about $4,000 worth of plants sold in 1870. He thinks that grape culture is destined to become one of the most important interests of the State.

Mr. J. H. Tice, of Saint Louis, says it is the opinion of Humboldt, Herschel, Bousingault, Marsh, and other scientists, that the destruction of forests diminishes the quantity of rain-fall, and causes it to be less equable and more deluging. Forty years ago large barges, loaded with goods, went up and down Cuyahoga River, in Ohio, but now a canoe can hardly pass down the stream. Mill Creek, in Illinois, once afforded water for milling purposes the year round; now it affords but little running water, and during summer and autumn is perfectly dry. The waters of the great western rivers are steadily diminishing. Steamboats, which could once ascend the Mississippi at all seasons of the year to Saint Louis, can now go no higher than Memphis. We are trying to deceive ourselves with the delusion that the quantity of water in our rivers is not diminishing, but that they are only widening their channels, and becoming more shallow. No proof can be brought to justify this conclusion. In Germany measurements have been made of the waters of the river Elbe for the last eighty years. The volume of water discharged is 18 per cent. less now than at the beginning of that period. The reason is that millions of cords of wood and billions of feet of lumber have been cut from the forests and mountains along its sources. On an elevated plain near the city of Caraccas, South America, the chocolate-plant found its most congenial climate; but subsequently the whole plain was denuded of its forests to extend the plantation. The result was that rains almost ceased, and the climate became so arid that the cultivation of the plant had to be abandoned. The trees were at length restored, and the cultivation of the plant has been resumed. Saint Helena had become almost barren, from having been stripped of its ancient forests. Within the last thirty years trees have been extensively planted, and the rain-fall is now about double. About fifty years ago Mehemet Ali planted forty to fifty millions of trees in Egypt, to increase the rain-fall in that country. Previously, there had been very little rain; sometimes not a drop for sixteen months. Now, the annual average of rainy days is about thirty. Mr. Tice attributes the increased quantity of rain produced by trees

largely to electrical influence. The rain-clouds, being positively charged with electricity, are attracted by the trees, which are charged negatively, and the tops of which are nearer the clouds than the plains.

' Electricity everywhere mounts to the highest points. Now, everything on the surface of the earth, as a house, tree, stem, branch, or leaf, adds its superficies to that of the earth, and receives its equal part in an electric distribution. Hence, an acre of timber-land, by its trees and foliage, may have its area of surface increased five thousand fold over an equal area of plains. Consequently, its electric potentiality will be increased in the same proportion. Hence its electric reaction upon the atmosphere will be in the same proportion, and will attract to itself more copious and abundant rains.

Mr. G. W. Kinney states that more than one hundred persons are reported to have died in the State during the past year of hydrophobia, occasioned by the bite of mad dogs. In thirty-two counties 10,602 sheep have been killed by dogs. He estimates that, allowing two dogs for each family, which is really less than the actual number, there would be 460,000 dogs in the State. The amount of food necessary to support a fair-sized dog will keep one hog in good thriving condition, which at twelve months will weigh 200 pounds, making for the whole number of dogs 92,000,000 pounds of pork. This would load 4,600 cars, ten tons to a car, and be worth, at 6 cents per pound, $5,520,000, nearly twice the value of all the school-houses in the State, and more than twice the amount used by the State, in 1869, for all school purposes. In consequence of the great amount of damage done by these animals, it has been proposed to the State Board of Agriculture to recommend to the legislature to pass a dog law, by which the owner shall be required to pay an annual tax of $1 on every male and $2 on every female dog.

Mr. C. V. Riley, State entomologist, says that the impression is prevailing that noxious insects are on the increase in the State, but the fact is otherwise. This opinion has probably arisen from the increased attention which has been given to the subject by the people generally, and from exaggerated accounts that have appeared in some of the agricultural journals. Many important discoveries in economic entomology have been made during the year. He has prepared a number of charts, with colored illustrations, of injurious insects, and intends to occupy a portion of his time in lecturing before the farmers of the State on the habits of insects and the modes of destroying them. There are about half a million species of insects, but they may all be reduced to one hundred families of characteristic types, which a child may learn to distinguish as easily as he can learn the one hundred different types or letters which compose the English alphabet, namely, the Roman capitals and small letters, and the writing capitals and small letters. He hopes, and fully expects, that text-books on the rudiments of entomology will soon be prepared and introduced into our common schools, and be studied by the children, as in the schools of Germany.

By an ingenious experiment made this year, Mr. Riley has settled the mooted question whether the plum curculio (*Conotrachelus nenuphar*) has one or two broods during the year. He inclosed a plum-tree, before the flowers had fallen, in wire gauze so close that a curculio could neither pass in nor out, by which he ascertained beyond a doubt that the plum curculio produces but one brood in a year, which mature during the season, and those which survive pass into the ground in the fall, as perfect beetles, just below the surface, where they remain until spring, and come out in season to deposit their eggs in the fruit as soon as it is sufficiently grown. He has also discovered, contrary to previous opinion, that they are most numerous on the trees during the night, and thinks this a better time for jarring the trees than early in the morning,

in order to catch them. Favorable mention is made of the method recently discovered for destroying these beetles in plum and peach orchards, by placing on the ground, around the body of the trees, pieces of bark with the concave side down, or chips, or pieces of shingles. The curculios collect on the under side of these chips to avoid the cold. The best time to remove the curculios from the chips is late in the afternoon of each day. The work of catching them should begin about the time the blossoms begin to expand, but it will not be of much use after the insects begin to work upon the fruit. Jarring the trees must then be the principal remedy. He regards the Paris green entirely objectionable and inefficient as a remedy. Several machines recently invented for jarring trees and catching the curculio are described, and said to work satisfactorily.

This year Mr. Riley has satisfactorily ascertained, by experiment, that the *Sigalphus curculionis* is a parasite which breeds upon the larvæ of the curculio, and destroys them in great numbers. He estimates that three-fourths of the larvæ of the curculio were killed by it in 1869. He is now propagating these insects for distribution in the different counties of the State, that they may be introduced into plum and peach orchards, and be propagated for the destruction of the curculio. He says the pea-weevil, or pea-bug, (*Bruchus pisi*,) does not deposit its eggs in the flowers or in the pea within the pod, as is sometimes taught, but on the surface of the young pods, without special reference to particular parts. They are attracted to the outside of the pod by a "viscid" fluid which dries white, and glistens like silk. As soon as the eggs are hatched, the larvæ bore directly through the pod, one entering each pea and making a puncture smaller than a pin-hole. As the pea and pod enlarge, the puncture closes up, and the larva excavates a small cavity in one side of the pea, leaving its outer coating whole. In this cavity it assumes the pupa state, and comes out a perfect beetle the next year, usually about the time the young peas are in bloom. If the weevils are in the peas when sown, they remain in the ground till the proper time to come out and deposit their eggs. He recommends for their destruction to inclose the peas, after they are perfectly dry, in a tight cask, and keep them over to the second year before sowing, which will kill the weevils; to put them into water just before sowing, when the sound ones will mostly sink, and those containing the weevil will rise to the surface; or to immerse them in hot water for one or two minutes, by which most of the weevils will be killed and the sprouting of the peas not injured.

Another weevil is described by Mr. Riley, which appeared about ten years ago in Rhode Island, and is now found in some parts of New York, Illinois, and Missouri. He has named it the *Bruchus fabæ*, or bean-weevil. It infests beans in the same manner as the pea-weevil infests peas, except that several larvæ usually enter the same bean. It is about half as large as the pea-weevil, and of a tawny gray color. He regards it as indigenous to this country, and as likely, if not checked, to extend itself through the country, and prove as destructive to beans as the pea-weevil has to peas. The same preventives may be used as for destroying the pea-weevil. For catching the larvæ of the codling moth, (*Carpocapsa pomonella*,) he prefers a band of rags to a band of hay, tied around the trunk of the apple-tree, as it can be more conveniently passed through a roller or scalded and used again. If put around the tree about the first of May, and examined once in two weeks, till the fruit drops off in autumn, almost every larva that crawls down or up the tree may be taken and destroyed. Rags placed in the crotches of

the tree or in the branches are of little consequence, as the larvæ will crawl around them.

A new worm has recently made its appearance in Missouri and Illinois, which Mr. Riley has named *Prodenia autumnalis*, or army-worm. It commences its depredations in August, and devours wheat, oats, corn, turnips, buckwheat, grass, tomatoes, &c. It travels in immense numbers, and destroys whole fields of grain or grass in a very short time. He has bred the insects, and finds that they produce at least two broods in a year; sometimes three or four. As preventives of its ravages, he recommends to plow ground, intended for fall wheat, early in the season, and to keep it clear from all vegetation till the wheat is sown; also to plow late in the season land on which the worms have been numerous, in order to kill the pupæ and larvæ which have entered the ground to spend the winter. When they are infesting grain-fields and covering the ground in large numbers, to roll the land with a heavy roller, which will kill the worms but not injure the grain.

NEBRASKA.

The third annual report of the State Board of Agriculture of Nebraska, for the year 1870, contains 363 pages. The report of the president, Robert W. Furnas, enumerates in detail the principal features of the State relative to agriculture, and gives a statement of its principal productions. The State has no mountainous districts and little rough or broken land, the general aspect of its surface being regular and undulating, gradually rising as it extends westward from the Missouri River, and becoming less rolling. The State is abundantly watered, especially through the eastern, middle, and southern portions, having the Missouri as its eastern boundary, the Platte flowing from west to east entirely through it, the Republican, Big and Little Blue, Nemaha, Niobrara, and other streams, and their numerous tributaries. Some of the most fertile soil of the State is watered by these streams, which are bordered with wide strips of bottom-lands. Very little is rocky. The valley of the Platte is ten to fifteen miles in width, and traversed by the Union Pacific Railroad. This portion of the State is rapidly filling up, as is the eastern; but there will long be room for settlers, as the State is one of the largest size, having a surface of 63,300 square miles, while New York has only 47,000. There was public land undisposed of in Nebraska, in 1868, to the amount of 41,624,000 acres. In 1870 there were 1,067,574 acres entered, of which 456,439 acres were for homesteads.

The climate of the State is good, the average temperature being in spring 49°; in summer, 74°; in autumn, 51°; in winter, 50°. The winter is short and mild, open and dry, with the sun usually unclouded. Little snow falls, which lies but a few days; nor is there much rain in winter. It is claimed that stock may be wintered well without shelter. Small grains are planted in March, and sometimes earlier; corn from the 1st to the 15th of May. The summers are long and warm, but the prairie breeze is as constant as the sea-breeze on the coast, tempering the heat, so that it is rarely oppressive. The autumn sky is unclouded, and that portion of the year exceedingly lovely. Less rain falls in Nebraska than in Ohio, Indiana, or Illinois; but tables compiled from the meteorological records of this Department, covering the time from 1863 to 1869 inclusive, show that the rain-fall during the months from April 1 to October 11 is but little less than in Missouri, Indiana, Ohio, and New York, and greater than in Illinois, giving to the agricultural months sufficient moisture.

The soil is from eighteen inches to two feet deep, being a vegetable

mold accumulated from the decayed vegetation of centuries, charged with lime, and is rich, black, and light. It rests upon a porous subsoil of yellowish clay, which has the property of holding water like a sponge. "The soil of Nebraska, resting on this subsoil, is like a rich, deep, friable garden mold thoroughly underdrained. It enables vegetation to resist alike an exhausting drought or excessive rains." The soil and climate seem adapted to the production, equally with other western States, of wheat, corn, hay, and the leading grain and root crops, and its good grazing capacity and the mild winters recommend it as a fine grazing country. "Considerable attention has been given to cattle-raising, and with uniform success." The report of the premiums awarded at the fair of the State board shows that thorough-bred stock is being raised in the State, and enterprise in this direction is encouraged by liberal premiums. The president says, in his report to the board:

Grazing must eventually be a great interest in Nebraska. The western part of the State contains much land growing a short, fine, rich, nutritious grass. It is now the pasture of the bison and the hunting-ground of the Indian. These grounds are well adapted to stock-raising; a great part of them are well watered, and the remainder may be readily made so by artesian wells, which do not need to be bored to a very great depth.

The wild grape and plums in great abundance, and the raspberry, gooseberry, and strawberry are native; and hops equal to the best cultivated are found in the groves along the streams. Experiments in the cultivation of apples, pears, and peaches have generally been successful, especially since the completion of the Pacific Railroad has rendered possible the speedy transmission of young trees from distant nurseries, and, more recently, since trees have become available from home nurseries. The committee of the State agricultural fair, which was held at Nebraska City in October, 1869, reported upon fruit as follows:

The excellent quality and remarkable size of the fruits were the subject of continual remark by all spectators, and especially those representing the older fruit-growing States. A single apple on exhibition measured, in circumference, sixteen and three-quarter inches, and weighed twenty-nine ounces. Pears and peaches, of astonishing size, shared with it the general admiration. One point of excellence which forced itself upon our attention was the apparently healthy condition of all fruit on exhibition. Absolute exemption from disease was the almost universal rule. The leading characteristics of the different varities showed a very near approach to perfection. As it was commonly supposed, only a few years since, that Nebraska could never become a fruit-growing country, the practical denial which experiment gives to the assumption is highly gratifying.

The following varieties of fruits, which have been found hardy in Nebraska, are recommended by the committee for general cultivation:

Apples.—Detroit Red, Ladies' Sweeting, Red Canada, Striped Sweet Pippin, Yellow Ingestrie, Northern Spy, Winesap, Autumn Strawberry, Red Gilliflower, Red Astrachan, Willow Twig, Red June, Todd's Pippin, Duchess of Oldenberg, Gabriel, Early Red, Drap d'Or, Williams's Favorite, New York Pippin, Early Joe, Snow Apple, Keswick Codlin, Mother, Summer Pearmain, Fameuse, Hyslop's Crab, Roman Stem, Small Siberian Crab, Newton Pippin, Buffington's Early.

Seventeen other varieties are reported hardy under favorable circumstances, and twenty-two tender, though cultivated in the State, and many of them exhibited at the fair.

Pears.—Stevens's Genesee, French Jargonelle, Seckel, Flemish Beauty, Bartlett, Eastern Beurré, Beurré d'Aremburg, Oswego Beurré, Buffum, Tyson, White Doyenné, Belle Lucrativè, Beurré d'Anjou, Duchesse d'Angoulême, Louise Bonne de Jersey, Vicar of Winkfield, Howell.

These were reported as hardy by all authorities present at the fair.

Grapes.—Norton's Virginia, Catawba, To-Kalon, Clinton, Anna, Concord, Isabella, Cassidy, Ives, Madeira, Creveling, Rogers's Hybrid 33, Delaware, Taylor's Bullitt, Diana, Hartford Prolific, Iona.

To encourage fruit-growing, the legislature has provided that $50 of the property of each tax-payer within the State who shall plant and suitably cultivate one or more acres of fruit-trees, at a distance apart of not more than thirty feet, shall be free from taxation for five years, a like amount being exempted for each acre so cultivated.

The report states that there is a supply of timber sufficient for present needs along the fertile and well-wooded valleys, consisting of cottonwood, many varieties of oak; the elm, white ash, hackberry, black walnut, hickory, basswood, coffee-tree, honey-locust, and sycamore. In some portions of the State, along streams, the beds of which are sandy or rocky, cedar and pine are said to abound. On the uplands, where fires have frequently swept the prairies, timber must be cultivated to furnish a future supply, and the work of planting is already initiated. It is claimed that every farmer can raise his own fuel in five years from the seed, by selecting that of rapidly growing trees, and thinning to proper distances as the growth becomes crowded; for in every portion of the State now settled timber grows rapidly. Cottonwood-trees in Douglas, Cass, and Otoe Counties have grown to the height of twenty to fifty feet, and to a circumference of one and a half to four feet, in ten years; soft maple fifteen feet, and over two feet in circumference, in seven years; common locust fifteen to twenty-five feet, and one foot ten inches to more than three feet in circumference, in ten years; Lombardy poplars grow twenty feet high in four years in Cass County; and in Douglas apple-trees ten to twelve years old have a girth of one foot and three inches to one foot and six inches. All that is needed to secure the growth of timber is to plant the seed or young trees, prevent the grass from overshadowing them while young, and protect them from fires. It is stated that "timber and live fence-growing in Southern Nebraska has already demonstrated the fact of a favorable change in both climate and productions, and more abundant rains."

The legislature has provided that $100 of the property of each tax-payer who shall plant and suitably cultivate an acre of forest-trees for timber, the trees to be not more than twelve feet apart, shall be free from taxation for five years; and a like sum for each additional acre. The State Board of Agriculture also offered a premium of $50 for the largest and best-cultivated grove of timber in the State, which should be set out in 1870; and premiums were authorized for hedges and orchards.

The report states that coal, marl, fine clay for brick-making, and salt are found in some portions of Nebraska; and in Richardson, Pawnee, Nemaha, Dakota, and Johnson Counties, light-colored and blue limestone; and in Page and Saunders Counties magnesian limestone, for building purposes.

An address delivered at the State Fair in September, 1869, touches upon many things concerning the development of the resources of the State. The president of the board, in his address, calls the attention of farmers to the importance of stock-raising and dairying, as there is and will continue to be a good demand for butter and cheese to supply the Pacific States, as follows:

Almost the first through shipment of the Union Pacific Railroad was twenty-seven car-loads of butter to California. For some reason but little butter or cheese is made in that State, and with the completion of the road a large and profitable market is opened for these articles. With our rich and boundless pastures, not one pound should

go to them, unless manufactured west of the Missouri River. We ought to be able to compete with the world in this, and hold the monopoly, by furnishing a prime article at a lower price than from any other source. And shipping any of these articles west means, to the Nebraska farmer, cash, quick sales, and the highest prices.

Mr. Frost claims that Nebraska stands second to California only in the production of the greatest crops of wheat per acre, and that lands which have been cropped fifteen years bear as good crops as when first cultivated. In corn and other grain, especially oats, a favorable comparison with other favored Western States is instituted.

Numerous reports from county societies were made to the board, and are printed in its annual report. Moses Stocking, of Saunders County, recommends the growing of rye to furnish green food for sheep in the spring until timothy and clover are grown. The rye fields, he asserts, may be pastured by these animals until the middle of spring, with little detriment to the yield of grain. The value of this grain, both for early and late feed, to supply the defect of the native grasses, is believed to be very great. Mr. Stocking states that the soil, climate, and grasses are uncommonly well adapted to sheep-raising, flocks are never diseased, and in the western half of the State wool-growing at 20 cents per pound would be a better business than wheat-growing has been in the eastern half. Forest-tree planting was continued in that county until the supply of young trees became exhausted, and Osage orange has been used abundantly for hedges. Three nurseries for fruit-trees have been recently established.

Mr. F. M. McDonagh reports favorable upon the growth of fruit-trees in Dakota County, over 3,000 having been brought into bearing recently. Timber is abundant. In Richardson County apples, peaches, pears, grapes, and small fruits generally are successful. One firm of nurserymen delivered $23,000 worth of fruit-trees at Rulo for planting in the county in 1869–'70. Forest-trees have also been planted extensively. In Johnson County about $10,000 have been paid for fruit-trees within two years, and Osage orange and honey-locust are grown in abundance for hedges. There is a prospect of the early completion of two railroads through the county, and several coal mines within its limits are worked successfully. In Saline County, which is new and thinly settled, the planting of hedges and forest-trees has been commenced; but little attention has been given to fruit. In Lancaster, Cedar, and Colfax Counties both forest and fruit trees are being planted in considerable numbers, and in Cass County special attention has been given to forest culture, and to fruit, which pays a large profit.

In Otoe County about 100,000 pounds of wool from Merino sheep are produced annually. Everything there seems favorable to wool-growing. Madison County is also favorable. In Dixon County Merino and Southdown sheep are kept; and numerous other counties report, from limited experiments mostly with Merinoes, conditions more than ordinarily favorable to wool-growing.

The State fair, under the control of the State Board of Agriculture, was held at Brownville in 1870, commencing September 21, and continuing four days. A new and commodious hall, ten hundred feet long by twenty-five broad, with eight hundred feet of tables, had been built, and stalls and sheds for more than five hundred head of stock had been erected. Both the hall and the stock-pens were filled, and the fair would have been a gratifying success had not rainy weather interfered. Notwithstanding this, the attendance was good and constant, and the report of the treasurer shows $2,850.95 paid in premiums and incidental expenses, and a balance in hand of $429.75. This report from a region not long

ago considered as a portion of the Great American Desert, exhibits to the reader, instead, a beautiful and fertile State, new but full of intelligent energy in her agricultural population, and destined to stand prominent among her sisters for enterprise and wealth.

NEW HAMPSHIRE.

The first annual report of the State Board of Agriculture, by James O. Adams, secretary, was made to the governor May 1, 1871, contains 360 pages. It embraces a history of the organized agricultural associations of the State; a record of the proceedings of the new Board of Agriculture; reports from many towns—over one hundred, or nearly half of those in the State, having responded to a circular in which the secretary made inquiries concerning the present condition of agriculture; brief histories of co-operative organizations, including the New England Society, the New Hampshire State Agricultural Society, and New Hampshire College of Agriculture and the Mechanic Arts, and the county agricultural societies throughout the State; also articles on the crops and drought of 1870, fertilizers, live-stock, land-drainage, grasses and forage-plants, plant-life, the cereal crops, the dairy, New Hampshire in comparison with other States, farming in New Hampshire, the new cattle disease, and noxious insects and their destroyers. The report also contains fourteen illustrations.

It appears that the first agricultural society in the State, of which there is any account, was organized in Rockingham County as early as 1814, and chartered by the legislature of that year. A society was organized in Cheshire soon after, and in Hillsborough and Strafford each, in 1827, and a small sum of money was appropriated by the legislature in the last-named year for their encouragement. In 1819 and 1820, societies existed in all of the six counties then in the State, and $3,000 had been appropriated and expended for the promotion of agriculture. A State Board of Agriculture, one of the first in the country, was chartered by the legislature in 1820, consisting of the presidents of the county societies, and one delegate from each. The board organized in 1821, with William Badger, president, and Matthew Harvey, secretary, both of whom were subsequently governors of the State.

The first report, now very rare, was made and printed in 1822, and was regarded as an able document. The board and its constituent organizations gradually died out, and no new board was appointed until 1870, nearly half a century after the first one reported.

The present Board of Agriculture, appointed by the governor, consists of ten members, one from each county, as follows: Moses Humphreys, of Concord, Merrimack County, president; James O. Adams, of Manchester, Hillsborough County, secretary; Thomas Cogswell, of Belknap; Sampson W. Buffum, of Cheshire; W. H. H. Mason, of Carroll; Luther B. Hoskins, of Grafton; Hiram R. Roberts, of Strafford; Joseph F. Lawrence, of Rockingham; Nathan R. Perkins, of Coos; John S. Walker, of Sullivan. Different members are detailed to attend the various county fairs and report upon them to the board; and the members are expected to visit the town fairs in their vicinities. The board held meetings during the year at Concord, Manchester, Milford, Winchester, Keene, Lebanon, Derry, Chester, Meredith Village, and Exeter, some of the members being present to unite with local organizations in encouraging discussion upon agricultural matters, rather than for conference among themselves. In this manner the board seems to have awakened much interest throughout the State, and to have secured the co-operation of its intelligent farmers in promoting agriculture.

In an address upon the subject of crops and the drought of 1870, delivered before the farmers' meeting at Concord, the secretary of the board recommended abundant manuring and deep stirring of the soil, as the best means to prevent the destructive effects of drought. Underdraining is commended as equally serviceable upon dry and wet lands in seasons of drought, as the soil is thus kept porous. Of deep tilling and high manuring he says:

> I have at this moment in my mind garden-lots deeply plowed, spaded to the depth of eighteen inches, and made rich with the manurial products of the barn-yard and hog-pen, which were covered with a luxuriant growth, while other lands side by side with them, that had not been thoroughly tilled, yielded to the influence of the weather, and were profitless.

In an article upon fertilizers, it is stated that those called commercial or artificial are used most abundantly where the lands are most fertile, showing that they stand the test by the side of composted and barnyard manures, and they are employed by the best class of farmers, nearly all premium crops having been grown with their use. In the town of Hatfield, Massachusetts, one of the best farming towns in the Connecticut Valley, $35,000 were expended in 1869 in commercial fertilizers, more than the profits upon farming in some towns where only common manure was used. Such fertilizers are claimed to be necessary upon land long in cultivation and enriched only by animal manure, and the use of the latter is not lessened or made undesirable by the employment of the former, both being needed to restore to the soil the qualities removed by the abundant sales in market of hay and other products once consumed upon farms.

More than half a million dollars are now annually paid for commercial fertilizers in the New England States and in New Hampshire, all which are offered for sale are analyzed under the direction of the Board of Agriculture, according to law, for the protection of the farmers against fraud. In three succeeding articles containing minutes of remarks by practical farmers at meetings of the board, the use of phosphates is highly commended as beneficial to old lands and the crops of the State. Colonel Clough stated that corn is made more productive by their use, and the crop advanced two weeks—an important consideration where there is frequent danger from early frost.

Dr. W. H. H. Mason states that, in late efforts to improve the sheep of New Hampshire, the results are the extinction of many flocks and the deterioration of those remaining.

These results are attributed to promiscuous crossing, without regard to the proper varieties that should be united, and inattention to other conditions of improvements. When crossing is promiscuous, bad qualities have an especial advantage. Some breeds, as the Southdown and Merino, cannot be improved by crossing with others; while native sheep are improved by it. The two objects of sheep-breeding, mutton and wool, are answered when we get the best mutton and most desirable wool. The full-blooded Merino is taken for a basis of the fine-wooled sheep, and the full-blooded Cotswold for the coarse; though he admits there may be a question of superiority between the latter and the Leicester, for coarse wool. But for health, hardiness, and longevity, the Cotswold ranks first among coarse-wooled sheep, and surpasses all but the Southdowns, which are best for mutton. They are also very prolific, and good mothers. Both Cotswold and Leicester make good crosses with our common sheep, giving to the offspring heavy wool, which is shorter and thicker than the fleeces of the former breeds. He disapproves of breeding-in, except occasionally, for the purpose

of "getting the blood," claiming that close breeding, steadily followed, contaminates the blood and spoils the beauty and symmetry of the animal. One cause of degeneracy in flocks he attributes to the use of young rams that have not become mature in bone and muscle, and lack vigor. This is of so much consequence that a sheep-grower who does not avoid the practice should not expect to be successful. He thinks that wool should be cut without washing the sheep, this being better for the health of the flock, and because well-washed wool brings no better price than wool poorly washed. Lambs, if vigorous, and the weather is not too cold, should be castrated when three days old, and by extracting thegland rather than excision, as they suffer less at that age, and there is no loss of blood by the method.

For breeding purposes it is recommended that the parents be selected from such as have small heads, as a hard parturition imperils both the mother and lamb. "Sell the large-headed lambs; keep the small-headed ones for breeders. A sheep with a small head and capacious chest filled with healthy lungs, with a fair development of other parts of the body, carries his own recommendation, and from whatever species, variety, or family he may come, will not fail in hardiness, health, and productiveness."

In discussing the qualities of the breed of cattle suitable for the State, at one of the meetings, Mr. S. W. Buffum said:

It is a shame that the agricultural society offers premiums for grade animals. It is a loss to the country and the State, and unworthy of any men called upon to offer premiums. It is going back a hundred years. * * * The Cheshire County cattle are worth a cent a pound more for fattening purposes than any other, simply because we use the pure blood instead of the grade bull.

Mr. Hiram R. Roberts, in an address concerning "neat stock for New Hampshire," states that—

Good judges estimate that any man may double the value of his stock in two years by the introduction of blood-cattle. Others estimate the gain as high as $10, yearly, per head. I think that $5 net yearly gain of blood-cattle over the native is not a high estimate, and would, if applied to all the cattle in our State, amount to the nice little sum of $1,500,000 annually.

Mr. George F. Beede states that the hay crop is the most important of any in New Hampshire, corn being second; estimating corn to be worth $1 per bushel, and hay $12 per ton, the value of the latter crop is six times as great as that of the former. The pasturage and hay of the State are worth annually $12,000,000 at a low estimate. The advocates of corn crops say that the yield can easily be doubled by proper selection of seed and improved methods of culture; and he thinks that the grass crops may be doubled sooner and more easily, adding another twelve millions to the income of the farmers of that State. His soil is heavy, brownish loam, resting on a yellow loam subsoil, and a somewhat clayey hard-pan; and the system which he found the best to secure satisfactory hay-crops is in substance as follows: After breaking up, he plants never more than two seasons, and before seeding with grain and grass-seed, applies the manure to the previous crop. He advises not to manure at the time of seeding down, unless it is done in the fall, as the straw is stimulated at the expense of the grain, making the yield light. In applying manure he does not plow it in, but after plowing deep, yet not deep enough to turn up too much of the subsoil, spreads it on the furrows and works it in thoroughly with the harrow and cultivator. The first harrowing is done with a coarse, iron-toothed harrow, in which the teeth are not less than ten inches long below the frame. The grain is sown after the first harrowing and covered with a steel cultivator, after which the ground is again harrowed, and re-harrowed with

the short projection of the drag-teeth underneath, to break up lumps in the soil. The heads of the harrow-teeth should extend three inches from the frame to be serviceable for this purpose. The land is now ready for grass-seed, which is sown mixed as follows: one-half bushel of timothy, one bushel of red-top, and ten pounds of western red clover-seed per acre. The process of seeding is finished with a roller or a brush-harrow, preferably the former, as it leaves the seed as evenly distributed as when sown. If the roller is in two sections, it will not drag the soil in turning. A roller is also best because it compacts the soil about the seeds, presses small stones into the earth, and leaves the surface smooth for mowing, and less exposed to the influence of drying weather. Mr. Beede's rule is to seed light with grain and thick with grass-seed to get a good catch and fine quality of hay, and he prefers wheat and barley to oats to seed with. He is careful to cut the grain above the top of the young grass-plants, as their leaves are the life and support of the plants. A mixture of pure fine-ground bone and plaster, in equal proportions, prepared a week before using, and sown at the rate of four hundred pounds to the acre on the clover after the grain is cut, is recommended as a lasting manure, which will increase the yield three to four tons of hay per acre in five years, as ascertained by careful experiment, and the cost would not be more than $8 per acre. Mr. Beede states that his best success has been with land seeded in the month of September, the grass-seed being sown alone; and that he raises grass crops most economically upon tile-drained land, which he considers the cheapest permanent draining, all things considered. On two and one-half acres of lowland, from which he got only one and a half tons of hay before draining, he cut, after draining, in one season, eight tons of cured hay, in two crops. The increase in the crop at market prices would have paid for the draining, which cost $50 per acre. He truly remarks:

> What a rush there would be among capitalists if there was an investment paying from 50 to 100 per cent. annually! Farmers have just such an investment in draining their wet lands and seeding them with the grasses.

The best time for cutting hay depends upon the use for which it is intended. Mr. Beede believes it best for young, growing animals and milch cows when cut previous to the appearance of the flower; for working horses and oxen, just after blossoming. He commences haying early, and feeds that which is first cut to young stock and cows, and the later-cut to working animals. The idea that late-cut grass spends best arises from the fact that its fibers become tough and woody, and it is less palatable to stock. The practice of cutting late tends to exhaust the land and run the grass-crop out. This he has learned from experiment. His recipe for making hay is, "Make hay the last of June and the first of July, when the sun shines."

As it regards the general management of grass-lands, in order to keep up their fertility and secure an annual heavy yield, there are the three methods of top-dressing, rotation, and breaking up in summer and reseeding in September. The top-dressing is simplest, cheapest, and most profitable. It does not require a very rich compost to give large returns. Top-dressing should be applied before the fall rains, the last of October or first of November. Six cords of compost, composed of four parts of loam, road-wash, muck, leaf-mold, or waste of charcoal pits, and one part of rich barn-yard manure, well mixed, are used on an acre, evenly spread and dragged in among the stubble with a heavy brush-drag. This top-dressing is applied after the third annual crop, and every second season thereafter until the land is again broken up. In this way more profit is obtained from the manure than can be had by applying it with a corn

crop. Mr. Beede sums up his observations and experiments in the following rules, covering the most essential points to observe in the cultivation of grass-lands: "1. The soil should be thoroughly prepared, drained, and well enriched; 2. Thick and even seeding; 3. Early cutting; 4. Frequent top-dressing."

The report contains an article concerning the appearance, in 1870, of an epizootic, new among the cattle of this country, called "the foot and mouth disease," which extended from Massachusetts into the southeastern portion of New Hampshire, and which has happily disappeared. The disease received attention in the annual report of this Department for 1870, under the head of *Epizootic Aphthæ.* Its appearance attracted the immediate attention of the board of agriculture, and caused the recommendation of legislation which would enable such persons as the governor might appoint to act with promptitude for the general good in case of the future appearance of such diseases among the cattle of that State.

Mr. W. W. Colburn, of Manchester, has a brief paper in the report upon the birds of the State, in relation to their benefit to the farmer. He divides them into three classes: those which do neither good nor harm, as the aquatic fowl, shore birds, and most of the game birds; those which do both, embracing the crow family and birds of prey; and those which may be said to do only good, including nearly all the order *insessores*, or perching birds. Of the second division, he considers only the harrier or mouse-hawk worthy of protection, the question as to the comparative benefit and evil of the crow family, including the jay, being undetermined.

This first annual report of the board of agriculture of New Hampshire contains many articles of special interest to the farmers of that State. Of this class is the address by Mr. J. F. Lawrence, relative to the agricultural capabilities of New Hampshire compared with those of other portions of the country, and the best means of inducing the young men of the State to remain at home in preference to emigrating to the West or other sections of the country. After visiting all the New England and many of the Western States, and observing their industries, soil, manner of culture, production, and natural characteristics, Mr. Lawrence affirms that, so long as New Hampshire can easily maintain twice her present population, her offers to her citizens are as generous as can be reasonably expected from abroad. He says:

> You will find no State whose laws give more ample protection to person and property, and which imposes burdens of taxation more justly, and under whose laws not only the broad acres of the wealthy are protected, but he who only owns a cottage and the soil on which it stands, may feel an indisputable right to what he claims, which no power, wealth, or combination shall wrest from him.
>
> There is no State under whose laws the wealthy or the stricken child of poverty shall share greater or more equal advantages for education. * * * Then, I submit, can we do better than to stand by and live in our noble State? Should we not put forth new efforts to make it what it can be made to be? We call our State rugged and broken, while others call it mountainous and beautiful. We leave it for the cities and sea-side for our pleasure, while those from distant States come hither to our mountains and stay here the entire summer, and only leave us to return when the spring birds return again. That we have sterile lands in New Hampshire it is useless to deny, but they can be left for grazing and the growth of fuel and timber. But there is good land enough in our State to easily support twice its present population. Ten acres make a large farm in England, but our farmers want to count their acres by the hundreds, and the consequence is that they are poorly cultivated, or scarcely cultivated at all. Let these good lands be divided and subdivided, and let new and cheerful homes arise all around us.

Mr. Lawrence states that fields in many parts of New Hampshire are kept in grass with profit longer than they could be with the same amount

of manure in some of the celebrated farming regions of neighboring States, and believes that with as liberal an employment of commercial manures and careful cultivation, the tillable lands would not be behind them in production and profitable returns. But that large farms and careless farming, which too often go together, and the rugged character of portions of the State, are wholly chargeable with the removal of its hardy youth and the decrease of its population, cannot be true so long as such advice as follows, given by the same writer, is needed in any general sense among its inhabitants:

Keep your boys and girls at home, but don't expect to keep them there by throwing to them the chaff and keeping the grain yourselves. Don't ask or expect improbable things of them. Don't expect them to love a home which has nothing in it to make it lovely, but where it is constant servitude from morning till night. Don't expect them to love your old hillsides when you have never given them anything there but hard, dull work. Don't expect your daughters will love the old homestead when they have got to leave it to learn the first lesson in culture or innocent pleasure.

Make your home cheerful, and you will make it a happy one. Instead of making the boy hoe all day on the hillside for you, let him hoe a half day there occasionally for himself. You have land enough. Plow up an acre for the boy, and let him have what he raises, and you will soon find that what little leisure time he has will be spent there instead of running to the village. Don't make him put all his proceeds in the bank, for he will soon tire of working for money, which does him no good. Let him take a certain portion of it, and buy something to read or to make his room or home pleasant.

NEW YORK.

The twenty-ninth volume of the transactions of the New York State agricultural society embraces reports of the executive committee; county, town, and union societies, farmers' clubs, and of the State entomologist; articles on the grasses and their culture; pleuro-pneumonia; abortion in cows; management of poultry; dipping, pouring, and shearing sheep; duties of veterinary surgeon in examining horses as to soundness, on improvement in agriculture; diseases of animals; importance of improved breeds of stock; discussions on capital in farming; treatment of dairy stock; bee-culture; fences and fence-building; and memorials of Benjamin P. Johnson, and Herman Ten Eyck Foster.

Mr. John Stanton Gould, in an article on the grasses and their cultivation, shows the great value of this department of agriculture on the prosperity and wealth of the country. He says 3,000 species of grasses are now known to botanists, and new ones are being constantly discovered by travelers in unexplored regions. Many of the species are perennial, and, unlike most other plants, are uninjured by cropping and the laceration of their herbage. To many species cropping is beneficial and absolutely necessary to prevent their running out. Of the whole number of species, only about thirty have been brought into general cultivation. The annual product of hay in the United States is not far from 25,000,000 tons, which, at $10 per ton, would amount to $250,000,000. The quantity of pasture-land is about double that of meadow, and the product would be worth as much as the hay from the meadow, or $250,000,000, making the total value of the grass crop in the United States $500,000,000. The annual value of the grass crop of New York is $80,000,000; of New England, $70,000,000. It is known from official data that the grass-fields in New York produce, on an average, ninety-six tons of hay to one hundred acres. Many farmers get two and a half to three tons per acre; and some get six or seven tons by cutting two crops in a season. Active and energetic farmers are not satisfied with less than two or three tons per acre on any soil, or in any climate. Near the city of Edinburgh, Scotland, twenty tons of hay have been

taken in one season from an acre of irrigated meadow-land, at six several cuttings.

Mr. Gould contends that the annual average crop of hay per acre may be doubled throughout the United States by proper cultivation. To accomplish this result, he recommends, first, that farmers make themselves acquainted with the different species of grasses in cultivation, and select such as are specially adapted to the soil in which they are to be grown, and to sow several kinds together; secondly, to manure frequently; thirdly, to reseed when grasses begin to die out; fourthly, to underdrain when the land is too wet and cold; fifthly, to irrigate, if possible, and especially if more than one crop is to be cut in a season; sixthly, to keep cattle from cropping the grass close to the ground, and poaching the fields late in autumn and winter; seventhly, not to mow too closely, especially timothy, which, if cut below the lower joint, is almost certain to die out. Thousands of dollars are lost annually by neglecting this one principle. One common reason why grass-seeds frequently fail to germinate is because they have been allowed to heat and mold in the mow before thrashing. Grass cut for seed should be spread out on the thrashing-floor, and turned daily until thoroughly dried. Mr. Gould concludes, by recommending that—

The young farmer should keep a blank-book in some convenient place, in which he may record all the observations on the grasses which he makes during the year. He should observe which is the first grass on the farm to start in the spring; which the cattle seem fondest of at different seasons of the year; which they thrive best on; which gives the most butter; which the most cheese; which exhausts the land most; which grows best on wet land, and which on dry; the different aspects presented by the same grass when growing on sandy and clayey soils; indeed, all the modifications produced by different soils on the same species; what kind of manures are best adapted to each soil; which loses the most weight in drying; the effect of early and late cutting on the succeeding crop; the insect enemies to which each kind is most liable; which matures its seeds best; the effect of shade and sunshine; which resists drought best; the size of the interspaces between the culms; the disposition to throw out stools from the roots. These and many other matters which will readily suggest themselves to the observing farmer, if carefully observed and accurately recorded, will soon give us an accumulation of reliable facts in all parts of the country which will enable us to establish a perfect science of the grasses. Guided by the knowledge thus acquired, we shall learn to adapt the different grasses to the soils most favorable to their production, and to increase the crops to an extent that we little dream of.

Professor James Law, of Cornell University, gives some excellent directions for detecting and curing diseases in domestic animals, and shows the necessity for a better knowledge of the veterinary art among agriculturists, to prevent losses and cruel treatment of real or imaginary diseases. He refers to a disease misnamed "hollow-horn" or "horn-ail," and protests against boring the horns or sawing them off and applying pepper and salt or other irritants for this disease as a fiendish practice, and says the true symptoms, which are those of fever, should be sought out, and the proper remedy applied:

If the animal is chill, shivering, or has a rough, staring coat, and if the horn is unnaturally cold, give an injection of three quarts of warm water, repeating it if it is thrown off. Administer by the mouth several quarts of warm gruel, containing six or eight ounces of whisky, brandy, or gin; or, if attainable, four ounces of sweet spirits of niter, or five drams of carbonate of ammonia. Blanket the patient warmly from head to tail, and actively hand-rub the limbs. A good plan is to heat dry bran, salt, and sand in a stove; put it in a long, broad bag, and lay it along the beast's spine from shoulder to rump; or wring a thick rug out of very hot water, lay it over the animal's back from head to tail, cover it with several dry rugs or buffalo-skins, and bind them closely to the skin with surcingles, that the heat may be retained. The limbs, meanwhile, may be actively rubbed, and then tied up in warm flannel bandages, loosely applied, so as not to impede the circulation. In half an hour the patient will usually be in a glow of warmth and covered with perspiration. The coverings must be removed gradually, one by one, and the damp one quickly replaced by an ample dry one, after one and a half to two hours. Dangerous inflammations in the chest, abdo-

men, &c., may often be warded off by these measures, when taken in the initial stage; and though a little more troublesome than the gimlet surgery, it has the compensating claims of being at once rational and successful.

He claims that real horn-ail is a disease of very rare occurrence, but it may sometimes exist. Matter collects inside of the horn, and even in the forehead, in larger quantity than can be readily discharged through the nostrils. It may be recognized by the discharge from the nose of whitish or yellowish matter, and sometimes pure blood; by the heat and tenderness of the root of the horns and forehead, by the hanging head, the partially closed eyes, great dullness and listlessness; and by the absence of a hollow sound when the forehead is gently tapped with the tip of the middle finger. Boring the horn with a gimlet or sawing off must not be employed as a remedy. "The treatment should be absolute rest, a dose of opening medicine, a semi-liquid, more stimulating diet, the application of cold water, or even hot fomentations, steadily maintained, to the forehead, steaming the nostrils by hot-water vapor, and, in obstinate cases, opening the cavity in the interval between the eyes, and syringing it out daily with a mild astringent lotion until a healthy action has been established." The operation of opening the forehead should be performed by a veterinary surgeon.

Sickness in hogs from indigestion, deranged biliary or urinary secretion, is sometimes attributed to an imaginary disease called the black tooth. The treatment usually adopted is to examine the teeth of the animal, and if one is found blacker than the rest, it is supposed to be the cause of the disease, and is hammered off even with the jaw, leaving the broken roots and lacerated nerves of the tooth to increase the suffering of the animal. Notwithstanding all this cruel treatment the hog sometimes recovers, and would probably have done so much sooner if he had been let alone. The tooth in these cases is not diseased, but only stained by food or otherwise. The cruel treatment of breaking off the tooth down to the nerve would certainly cause disease, and might, in connection with the true one, cause the death of the animal. A proper treatment would be to wash the hog thoroughly with soap and water, and give it three or four ounces of castor-oil.

Mr. Harris Lewis, of Herkimer, recommends that great care should be taken by dairymen to select good cows, and to endeavor to improve the stock by breeding. He has some cows which have yielded seven hundred pounds of cheese in a season, while others in the same herd did not produce more than two hundred. He would raise his own cows, and use natives to begin with, in getting a breed valuable for their milking qualities. For a bull he would select a good thorough-bred animal of the breed desired and descended from a good milking variety. His choice of breed is decidedly in favor of the Shorthorn, unless the pasture is poor, in which case he would prefer the Ayrshire. Cows should be milked gently and quietly in regular order, beginning each time with the same number, as number one, two, &c. When treated in this way they will yield more milk and give it more readily.

As a preventive of the milk-fever, Mr. T. L. Harison, of Saint Lawrence, gives his cows, once a week for three weeks before calving, a dose of one pound each of Epsom salts, with the addition of an aromatic, generally a tablespoonful of ginger; and never allows them to be chilled after calving, or to drink cold water before its chill is removed.

Mr. F. D. Curtis, of Saratoga, was once accustomed to milk his cows through the winter, and up to the very day of calving; but he found that they gave very little milk the next season. He now allows them to go dry about the 1st of December, and finds it pays in milk, and no

calves are lost in the spring. He feeds some roots to his cows every day, and considers them an excellent preventive of constipation. Mr. J. Shull, of Ilion, says the quality and quantity of food, and the time and manner of feeding and housing dairy cows, require careful study. A comfortable stable with proper ventilation is requisite. The temperature should be kept as even as possible. A tight stable, without proper ventilation, becomes warm and moist, and the air offensive. Cattle kept in a stable which is too tight, will suffer from cold when turned out to water and exercise much more readily than if kept in one properly ventilated. It is the practice of many dairymen to turn their cows out of the stable in the morning, and leave them out all day, whether the weather is fair or stormy. This is wrong. Every dairyman should have a proper and convenient place near at hand for watering his stock. Requiring them to go a long distance to some spring or brook is injurious and dangerous to the cattle.

The usual food for wintering dairy stock is hay and cornstalks, which should be cured when green, and with care. Hay should be made of grass cut in season and properly dried. Experiments have shown that cattle will eat early-cut hay clean, while they will leave a part of that which is cut later, or when it is about ripe. There is more weight in the late cut in consequence of the woody fiber which it contains; but it is not so nutritious as the former. Dairy stock should be fed regularly and at stated times. Some feed twice each day, while others feed three, four, or even five times. He has made inquiries as to results of feeding, in different dairies, and finds that cows fed twice a day, morning and evening, will winter better than when fed oftener. At each feeding a sufficient quantity should be given to satisfy them. If their stomachs are continually, or at frequent or irregular intervals, supplied with additional food, no time is allowed for chewing and proper digestion. Food is most beneficial to an animal when it is of the proper quality and quantity to fully supply the requirements of nature, and a proper time is allowed for its digestion. The stomach is then prepared to receive the next meal, and in this way is kept in a healthy condition. The quantity will depend upon the size of the animal.

Mr. M. Quinby, of Saint Johnsville, prefers the movable-comb bee-hive on account of its special fitness for removing the honey, feeding the bees, and for artificial swarming. Bees generally store much more honey than their necessities require. With this hive each sheet of comb may be taken out when it is filled, and the bees will restore it; or the comb may be emptied of its honey by means of a machine used for that purpose, and the empty comb be replaced. In this case the bees will need only to fill the old comb-cells. This makes a great saving of labor for the bees, as they will collect thirty pounds of honey in the time it would take to make one pound of comb. It is estimated that a swarm of bees, when supplied with the comb, as may be done with the movable comb-hive, will store more than two hundred pounds of honey in a favorable season. Artificial swarming may be easily effected by the use of the movable-comb hive.

As soon as signs of swarming are detected in a hive, a portion of the comb-sheets may be removed to a new hive. In the hive where the old queen remains, the queen-cells, which are easily found, should be destroyed. In the other hive they should be allowed to remain. Let the old hive then be moved a little to one side of its former position, and the new hive placed a little to the other side. When the bees return they will seek the old place, and, not finding the hive there, they will divide about equally between the old and new hives. After a swarm has been once divided in this way it can be prevented from swarming again by destroying the queen-cells whenever any indication to swarm is detected.

It often happens, especially in unfavorable seasons, that bees do not

store sufficient honey to support them through the winter. In this case they must be fed. The fall is the best time for feeding them. Mr. Quinby prepares an artificial compound by dissolving four to eight pounds of white crushed sugar in a quart of water, scalding it slightly, and putting in a little cream of tartar to keep it from graining. He introduces this into the cells of the comb-sheets by dropping it from the distance of a few feet through a perforated pan. When one is filled in this way the comb is reversed and the other side filled. The atmospheric pressure will retain the liquid in the cells on the under side. A sufficient quantity may be supplied at one time in this way to last through the winter. Ninety thousand pounds of honey were shipped in 1868 from the stations of Herkimer, Little Falls, Saint Johnsville, and Canajoharie. It was gathered from an area of about four hundred square miles, and was thought to be not more than one-tenth the amount which might be produced in that region. At this rate 50,000,000 pounds might be made in the State, which, at twenty-five cents per pound, would amount to $12,500,000. During the year 1868, Mr. J. C. Hetherington, of Cherry Valley, marketed over 21,500 pounds of honey, which is the largest amount known to be sold by any one person in a single year, of his own production.

It is stated by Mr. X. A. Willard, of Little Falls, that in Vermont the American Improved Imperial beet is preferred to all other roots for stock-feeding, being more productive and more nutritious. The average weight is four to eight pounds, though it sometimes grows to a much larger size. Mr. Henry Lane, of Addison county, has raised specimens weighing twenty pounds each. They are solid, brittle, and keep well. They grow best on clay soil or clay loam thoroughly under-drained. Mr. Lane uses at the rate of twenty-five loads of well decomposed manure to an acre, one-half being plowed in and the other half spread on the surface. By pursuing this course beets may be raised on the same ground for a succession of years. He sows his seed as early as possible in the spring on low, flat ridges, making the distance between the rows two feet, and between the plants in the rows one foot. At this distance an acre will yield 17 tons, or about 567 bushels, allowing each beet to weigh four pounds, and 60 pounds to a bushel; but the ordinary yield obtained by Mr. Lane, and throughout Addison County, is 28 to 32 tons, or 1,067 bushels per acre. The cost of raising is about 8 cents per bushel.

Mr. R. Gibson, manager of Messrs. Walcott & Campbell's stock-farm, near New York Mills, cultivates a new variety of mangold, which is intermediate between the Mammoth Red and the Yellow Globe. It is very smooth and handsome; yields better than any variety except the Mammoth, and keeps better than that. He prepares his ground for the next year, after a crop has been taken off in the fall, by loosening it with a three-horse cultivator, and then harrowing. After a sufficient time has been given for the weeds to germinate, it is well plowed, rolled, and harrowed. In this way two crops of weeds are destroyed, which brings the land into a better condition for spring cultivation. During the winter manure is applied direct from the barn-yard and spread on the surface. In the spring the soil is loosened again by running the cultivator two or three times through it, or by plowing, if found necessary. The seeds are sown in drills on ridges twenty-seven inches apart about the 15th of May, or as early as the ground will permit. About six pounds of seed are required for an acre. He has raised on a small plat at the rate of 2,030 bushels, of 60 pounds, to an acre.

J. A. Carey, secretary of Saratoga County Agricultural Society, urges

the necessity of divesting farming of the drudgery which too often attaches to it. He says:

There is no real necessity for making the life of the farmer one of drudgery and incessant toil. A portion of his time may be more profitably spent in thought and meditation, in devising the ways and means of lessening his labors through inventions and the application of labor-saving machinery, by which the labor of one man will do more and accomplish more in the management of his farming operations than half a dozen could by manual labor alone.

Report for 1870.—The thirtieth annual report of the transactions of the society is a volume of 595 pages. In addition to the usual matters pertaining to the immediate affairs of the society, a number of elaborate essays and well-matured addresses are embraced, rendering the volume one of permanent interest and value. Among the more prominent of these may be mentioned an article on the principle of breeding domestic animals, by Professor James Law, of Cornell University; an address on the subject of wool and mutton production in the United States, by J. R. Dodge, of the Department of Agriculture; a report on market systems, by Joseph B. Lyman; a paper on farmers' homes, by F. D. Curtis; recent improvements in the cultivation and management of hops, by Charles Whitehead; American grape culture, by Dr. S. J. Parker. Copious extracts are made from Dr. Voelcker's reports on artificial manures, sugar beets and beet-root distillation, the best mode of preparing straw chaff for feeding purposes—published originally in the Journal of the Royal Agricultural Society of England. Also, a contribution to the biology and history of the *Ustilagineæ*, by Dr. A. F. von Waldheim, of Germany, translated specially for the report. The reports of the State fair association and of local societies are full, especially the latter, and convey very flattering exhibits of agricultural prosperity throughout the Empire State.

At the annual meeting of the State Board in February, Miss Morgan, agricultural and live-stock editor of the New York Times, delivered an address in which reference is made to the system of cattle transit existing in this country, as a thing to wonder at. Cattle trains never arrive on time; the animals in some instances die, and always become much deteriorated from being kept too long on the cars without food, drink, or rest. It is suggested that it would pay the farmer better to slaughter his cattle at Abilene or Chicago, and forward them in the cool months of the year in properly constructed cars, than to be subject to the losses entailed by the present ruinous system; and in hot weather improved cattle cars and rapid transit by night should be resorted to. The cattle yards in and about New York City are badly constructed—too hot in summer, too much exposed to severe weather in winter; animals kept in them lose weight, and, therefore, value.

Concerning the best manner in which to meet the great want of skilled farm help, the speaker suggested the establishment of reformatory schools, where vagrant children might find a comfortable home and a course of agricultural education. "All large cities overflow with a surplus, and consequently dangerous population. On reliable information, I am led to believe that it costs in a general way $2,000 to hang an adult felon. Now, I think it would be wiser to spend a like sum in educating infant vagrants, who, if not so cared for, may become objects fit for the exercise of the hangman's craft."

Concerning the improvement of animals by breeding, Mr. Law adduces the instance of the Ancon ram, the parent of his race, born with short legs and a long heavy body, whose descendants rarely, if ever, have failed to breed true to the paternal type. Another instance is

given in Colling's bull Hubback, which has so influenced the breed of short-horns that he may be called the father of the race. Some of the earlier English thorough-bred stallions transmitted their characteristic properties to their offspring in an equal degree. Eclipse, which gained in prizes over £25,000 in seventeen months, and brought enormous sums for his services as a stallion, left among his offspring 334 winners, which brought their owners £160,000, besides cups and plates. King Herod got 497 winners, which brought their owners £201,505. *High feeding* tends directly to variation and improvement. Wild animals not only decrease in number on a limited supply of food, but the survivors are dwarfed. So in domestication, a liberal diet is essential to excellence and advancement.

Mr. Law urges that "the forcing system, to which it is found necessary to subject our best Short-horns, consists not merely in high feeding, but in maintaining by artificial means a mild and stimulating climate in warm buildings. In some respects this may enervate the animals, but without it we could not hope for extreme excellence in early maturity, and in assimilation and fattening qualities. So with the advanced breed of sheep, of horses, of swine. Beyond a limited amount, exposure is incompatible with high excellence. In many cases it is impossible to acclimatize these superior breeds in exposed localities."

Among the concluding suggestions of the address on wool and mutton production, Mr. Dodge advised farmers to adapt their business to the changing exigencies of the times and the progress of the country, making fat mutton and fine lambs the leading considerations in populous regions, where the demand is imperative for more food for the people, and improved culture of the soil, and leaving the production of wool alone mainly to the pastoral regions of the far West, where 8,000,000 to 10,000,000 sheep are now profitably kept, in place of scarcely 2,000,000 in the Territories and Pacific States in 1860. The region west of the Mississippi now yields nearly as much wool as the country produced in 1860, and is capable of producing enough for the supply of our population for many years to come, without the importation of a single pound. The address contains elaborated wool statistics.

In treating the subject of a better market system, Mr. Lyman urges the farmer to forward his produce in packages that are perfectly honest, putting big apples in the middle of the barrel as well as at the ends; keeping straw and weeds and corn-stalks from the middle as well as from the hoops of his hay bales. He very well says that—

It is always a brass shilling that a man makes by a trick in packing. If he has a good name on the wharves such deception kills it, and he will work twice as hard, and wait twice as long, to regain an enviable repute, as it requires to win at the outset. Let him be wise, also, in classifying his loads, and send, if possible, only one grade at one shipment. * * * * * Let the single farmer, unless his means are very limited, go to New York at least once a year, and make acquaintance among the commission merchants, and learn the ways of the metropolis. He may hit upon some worthy citizen who will offer to give him 60 cents, the year round, for ten pounds a week of sweet, yellow, firm-grained butter, who will take his honey, his lard, his jellies, his currant wine, his maple sirup, his fresh-laid eggs, and his plump chickens, at good prices.

Mr. F. D. Curtis thinks that an ice-house ought to be considered indispensable to a well-regulated farm residence. As the best manner of construction, he recommends an addition on the north side of the kitchen or wood-house, connecting it with a dark room, to be used for a store-room. Having the ice on one side, only a partition between, and no window or ventilation except at the top, this room would be always cool and free from flies.

To be handy, the ice could be taken out from the ice-house through a door opening

into this room, and be closed on the outside all the year, except when it was necessary to be open in order to put the ice in. The first cost of this addition would be but a trifle, and the expense of getting the ice nothing at all, for the farmer could do all that himself.

The paper of Mr. Curtis contains many arguments and illustrations in favor of farmers paying more attention to the comforts of life, and the adding of greater dignity to their pursuit. Home should be made attractive, and the boys and girls of the farm should not, through disgust of the rudeness and repulsiveness of their country surroundings, be attracted to cities and towns. Attention should be paid to food. Pork is the most expensive food, besides its tendency to make people gross and vulgar. A great pork-eater, and a man of delicate sensibilities, are opposites. A pound of chicken can be produced on a farm as cheaply as a pound of pork, and the same is true of mutton—both better than hog flesh. Eat more poultry and mutton. More attention should be paid to the setting out and care of fruit-trees for domestic use. If the house and the things about it grow beautiful, "the children will grow contented, the fathers and mothers as they grow old will grow happy, the neighbors will grow to emulate and to excel, the township will grow attractive, and the young men and the young women will grow up to think and to feel that there is no place, after all, like 'home, sweet home.'"

In his article on American grape culture, Dr. Parker expresses the opinion that we have scattered over our vast national domain germs of what might be good grapes; that in the wise selection, and, if possible, the improvement of these wild germs, lies the true path of American grape culture. As one plan of improving our native grapes, the writer argues at length the necessity of hybridization. Reference is made to the experiments of Mr. Rogers in the crossing of foreign upon native varieties.

The report of the judges of implements at the State fair, to whose judgment practical tests of farm machinery of all kinds were submitted, is very thorough, and indicative of exceeding care in the determination of the relative merits of the competing implements and machines. This is a new feature in the efforts of the society, and promises excellent results. There are so many candidates for public favor among labor-saving implements that it is not out of place for State societies to resort to thorough tests of comparative excellence.

The report of the American Institute of the city of New York, for the year ending February 2, 1871, shows success not only in its financial management, but in the substantial benefits conferred. The committee on agriculture states that the weekly proceedings of the society are published in most of the agricultural papers, and in the newspapers of New York City; affording a vast amount of timely reading on the subjects which are discussed by the club. Thousands of parcels of flower-seeds, cereals, and choice new varieties of potatoes, grafts, cuttings, grape-vines, and strawberry and other plants were distributed during the year, and committees from the society visited Virginia, North and South Carolina, Georgia and Florida, Ohio, Kentucky, Utah, Colorado, and California. From each of these States most valuable information is reported as having been obtained. A number of committees visited many portions of New Jersey and Pennsylvania with like results.

OHIO.

The twenty-fifth annual report of the Ohio State Board of Agriculture contains the proceedings of the board, a full account of the State fair for 1870, proceedings of the twenty-sixth annual convention, and reports

of county societies; also, essays on the agriculture of Auglaize and of Ashland County, on the breeding of swine, and of Short-horn cattle, and the soiling of cattle; a history of wine culture in Ohio; an address on dairy husbandry, by John H. Klippart; a statement of the Madison County cattle sales, and the usual statistical information. As an appendix, the fourth annual report of the Ohio State Horticultural Society is included in the volume, which comprises 750 pages.

The State fair was a very successful one. Among the changes in the premium list was the offering of $1,000 for the best five acres of wheat, and it is claimed by the corresponding secretary of the State board, Mr. Klippart, that the aggregate amount of premiums is the largest ever offered by any agricultural society in the Union.

The display of superior breeds of farm stock was large. The entries of thoroughbred horses, cattle, sheep, and swine, indicate an increasing interest in the important subject of improved breeding. Acting under a resolution of the State board of agriculture, the secretary, assisted by two experts, tested all worthy articles of machinery and machines entered for competition. The examination appears to have been thorough; among other articles examined were a self-registering dynamometer, for testing draught in trials of mowers; improved horse-power and hay elevator; "the champion post-auger;" the "improved universal wood-worker," designed for doing all kinds of carpentry work; dusting, tiling, and ditching machines; plows; hand-drills; sewing machines, &c.

The twenty-sixth annual convention of the State Agricultural Society was held at Columbus, in January, 1871. In the course of his opening remarks, President Ross expressed the opinion that the rapid increase and wide distribution of short-horn cattle were almost wholly due to agricultural exhibitions, as stimulating the enterprise of farmers and growers. This breed was introduced into the State about forty years ago, by importation from England. During the twenty-one annual exhibitions or State fairs there has been paid as premiums $24,632 upon 4,024 animals exhibited. Of this amount $14,753 has been awarded to short-horns.

The importance of introducing the study of veterinary science into the State Agricultural College was discussed by Dr. Townshend, who said:

> The necessity of a thorough course of veterinary instruction in the Agricultural and Mechanical College of the State, will be apparent from a consideration of the amount of capital invested in live stock in the State, and the many and heavy losses to which the owners are subjected. From the auditor's report for 1870 we learn that the assessed value of our live stock is in round numbers $100,000,000; horses and mules, $50,000,000; cattle, $32,000,000; sheep, $11,000,000; and hogs, $8,000,000. The annual income of this stock, in the form of wool, beef, pork, butter, and cheese, exceeds $50,000,000, and this does not include the labor of horses, which I cannot easily separate from the account of grain and other products.

Dr. T. estimates that intelligent sanitary management of stock, and a rational treatment of disease, would save to the State fully $5,000,000 annually; and that if the management were as good as it might be, the annual profits from animals would be nearly doubled.

Mr. T. C. Jones expressed the opinion that in most parts of Ohio land is too valuable to justify the raising of sheep for wool alone, or for wool as the primary object. There can be no successful competition with the wool produced upon the cheaper lands in the mountains of Virginia, Tennessee, &c., or on the prairies or plains of the West; but small flocks of good blood, to supply breeding animals for other sections, can always be profitably raised in Ohio. He recommends the "Downs" as

the most hardy among all the mutton breeds. For quality of flesh they are unequaled.

The prize crops for 1870, as adjudged by the committee, were corn and sweet-potatoes. Mr. Burras, of North Fairfield, from nine acres and six rods, reported a yield of $777\frac{42}{56}$ bushels of corn. Cost of production, $125; sales, corn, $366; stalks, at $2\frac{1}{2}$ cents bundle, $67.50, pumpkins $20—$453.50. Profit, $328.50. To the cost of cultivation should be added interest on money invested in land, $42.20; taxes, $1.50; wear of tools, say $2, $45.70, making a total cost of $170.70, and a net profit of $282.80. Soil, a sandy loam.

On six acres, sandy loam, D. C. Richmond, of Erie County, raised 1,541 bushels of sweet-potatoes, at a cost of $198. Returns from sales, $1,867.71, or a profit of $1,669.71. The plants were set eighteen inches apart, in ridges which were four feet apart.

In regard to raising corn for seed, Mr. Burras says:

> In shelling corn for seed, discard the butts and tips, using only the central portion of each ear, as the early blade and root are in size in proportion to the kernel used; and a plant from the large grains of the center of the ear will get the start and keep ahead of the smaller ones from the tip. This is not all theory, but the result of experiments with seed from the different portions of the ear, tips producing (as a rule) much smaller ears than butts or central ones; butts producing many one-sided, deformed ears, and not filling out well.

The reports of county societies show an increasing interest in the improvement of agricultural methods and in horticulture. The careful statements concerning rotation of crops, methods, and cost of cultivation of staple products, and the profits realized from them, &c., are of value to the farming interests at large.

In the county of Delaware, Isaac Fleming raised a crop of flax-seed, on a little over three acres, at a cost of $72.54, and, selling the product at $136.54, realized a profit of $64.

In the county of Champaign a yield of $97\frac{1}{2}$ bushels of corn on one acre is reported; cost of production, $14.50. The yield of apples in Seneca County, on six thousand acres, was 200,000 bushels. Green County raised the largest quantity of flax-seed—27,039 bushels. Erie County leads in the production of grapes—7,347,638 pounds; Ottawa County is next—3,774,005 pounds; and Logan third, which produced 1,368,935 pounds. The total number of pounds produced in the State during the year 1870 is 15,853,719.

Of cheese, the counties producing most largely were Ashtabula, 5,758,000 pounds; Geauga, 4,959,733; Portage, 3,822,829; Logan, 3,693,838. In 1870 the total number of pounds manufactured in the State was 31,381,038; number of factories reported, 130.

A remarkable ratio of increase in the wheat production in Auglaize County, within four years, is noted, viz: in 1866, 80,362 bushels; 1867, 81,740 bushels; 1868, 145,351 bushels; 1869, 269,799 bushels. This county has in cultivation annually about twenty-two thousand acres of corn, with an average yield of over 31 bushels per acre.

In the history of Ashland County, given in this volume, it is mentioned that rotation in crops is practiced to a great extent, although there are instances where single crops of corn have been raised every year on the same land for over forty years, with an abundant annual yield. The crop of oats in 1869 amounted to 600,000 bushels on sixteen thousand acres, or nearly 40 bushels per acre. Area in corn, twenty thousand acres, yielding 700,000 bushels. Annual production of butter, 600,000 pounds.

The receipts of the respective county fairs indicate a growing interest on the part not only of agriculturists, but of the non-farming pub-

lic, in the annual display of farm and garden products and labor-saving mechanical contrivances.

The premium for the best essay on the history and description of swine was awarded by a committee of the State Board of Agriculture to John M. Millikin. In this practical paper Mr. M. says:

The magnitude of the moneyed interests involved in pork-raising is very large. Ohio produces an annual average of 2,000,000 hogs, whose assessed value, for taxation purposes, will average about $8,000,000 per annum, and whose aggregate value, when fattened and sold, amounts to an immense sum, varying from $30,000,000 to $50,000,000 per annum. The amount of money invested in this branch of husbandry, as well as the labor, care, and expense incident to breeding, rearing, and fattening so large a number of animals, make it a matter of the greatest importance that farmers should ascertain and use the very best breed of swine obtainable at a reasonable cost. No statement of facts or arguments are necessary to demonstrate the immense sums of money which our farmers annually lose by breeding from stock of conceded bad quality. This loss is wholly unnecessary. Good stock for breeding purposes is always within the reach of breeders who have either ambition or pride, or of those who consult alone their pecuniary interests.

The paper of Mr. Klippart, on dairy husbandry, gives at length the results of a personal inspection of dairies in Europe. It is replete with valuable statistics and experiments. It is the opinion of Mr. Klippart, that if Germans find dairy farming remunerative with land at $300 to $400 per acre, and cows worth $120 to $160 per head, it certainly should be equally remunerative in Ohio, where both land and cows are valued at less than one-half the German values, the products of the dairy, cheese and butter, commanding very little more in Germany than in Ohio. There are fully 10,000,000 acres in Ohio admirably adapted to dairy purposes. As to the value of milk, as an article of food, the inspector of milk at Providence, Rhode Island, is quoted, who says that the nutritive value of milk, as compared with other kinds of animal food, is not generally appreciated. He estimates sirloin steak, (reckoning loss from bone,) at 35 cents per pound, as dear as milk at 24 cents per quart; round steak, at 20 cents, as dear as milk at 14 cents; eggs at 30 cents a dozen, as dear as milk at 20 cents a quart. Laborers who pay 17 cents for corned beef would consider themselves hardly able to pay 10 per quart for milk, when, in fact, they could as well afford to pay 15 cents. Relatively speaking, then, milk at 10 cents or even 12 cents a quart, is the cheapest animal food that can be used." Mr. Klippart concludes his essay with the following suggestions:

It appears to me that the great amount of capital and labor invested in dairy farming in Ohio would fully justify dairymen to make experiments somewhat after the method of the Germans, and to keep a precise record of the cost and result of every experiment; and especially should there be experiments with the grasses, to ascertain if possible which one, if any one grass, yields the greatest flow of the richest milk; and furthermore, I feel fully assured that it would "pay" the Dairymen's Association to employ a practical technological chemist to make frequent analyses of the food—milk, butter, and cheese. These analyses would demonstrate how much labor, material, and capital are misapplied, and how much greater and better the result will be when all is properly, and, of course, economically applied.

At the meeting of the State Horticultural Society the various sections of the State were fairly represented. In his annual address the president of the society, remarking upon the condition of horticulture in the State, said:

We sometimes feel inclined to boast of our wonderful progress, and, indeed, many of us have witnessed great changes since the early settlement of the country in our boyhood. The few miserable wild fruits have given place to the luscious products of our gardens and orchards; the acerb frost grapes, that were then eagerly sought for, are now neglected for the purple clusters of our trellisses and arbors; the plain diet of hog and hominy is now varied by a more extended assortment of vegetables. There was a variety of opinions concerning the cropping of vineyards with clover, the prevailing opinion being that the benefit derived from such cropping consisted in the shading of

the ground during the hottest season. It was recommended that the clover be cut when its growth is mature, and then be left as a mulch upon the ground, between the rows of vines.

Mr. Bateham stated that "in his vineyard, on a sandy slope, a dozen or more bearing vines grow near a very large cucumber (magnolia) tree, where the entire moisture, in time of drought, seems to be sucked out of the soil by the roots of the tree; but these vines each year ripen earlier and produce better fruit than any others in the vineyard of several acres."

Mr. G. W. Turner presented a new seedling of the Catawba, the fruit a trifle smaller than the parent, and seeming to ripen a little earlier, with less pulp and acidity.

Mr. Bateham thought the neglect of pruning peach trees was a common cause of defective crops, especially when the trees are old or from any cause unthrifty, as there must be young wood and healthy foliage for the production of good peaches. As a remedy for the "peach-borer" he recommends the following recipe:

I take a five-pound can of carbolic soap, called "carbolic plant-protector," (costing two dollars,) dissolve it in ten or twelve gallons of hot water by stirring or letting stand over night, then add twenty gallons of cold water, and apply this liquid, with a paint-brush, to the base of each tree, for eight or ten inches in height, first clearing away any weeds or loose dirt with a hoe, and taking pains to have the liquor enter the crevices of the bark where the insect deposits her eggs. An active man or lad will go over, in this way, five hundred trees in a day. If the orchard is in clean condition the above quantity of liquid will serve for one thousand trees, so that the expense is not over half a cent per tree.

The middle of July is suggested as the best time for applying the remedy in that latitude—northern Ohio.

A resolution of practical value was adopted by the society, looking toward the appointment of one or more of the members of the executive committee to visit different sections of the State during the fruit season, to attend meetings and exhibitions of local horticultural societies and to encourage the formation of such societies where none exist, to take notes of new or rare fruits and vegetables, investigate diseases and insects affecting fruit, and to collect items of interest to the State society.

The number of acres of orchards in the State in 1869 was 346,826; bushels of apples produced, 15,518,685; peaches, 1,444,523; pears, 147,022. Number of acres of grapes, 10,477. The product of grapes, (only one-fourth of a crop,) was 3,794,899 pounds. The grape crop of 1870 is claimed by the secretary of the society to have been tenfold that amount. Estimating apples at 40 cents per bushel, the total value is $6,207,474; peaches and pears, at $1 per bushel, $1,591,545; grapes, at 6 cents per pound, $228,994—making a total of $8,028,013. Adding an estimate for strawberries, raspberries, blackberries, and cherries, say $1,971,987, (claimed to be a low estimate,) the fruit production for 1869 would show a cash value of $10,000,000.

PENNSYLVANIA.

The seventh volume of the Transactions of the Pennsylvania State Agricultural Society contains a report of the agricultural college and experimental farms; articles on the changes produced in plants by cultivation, the progress of agriculture, the country roads and road laws; several bearing upon the practical aspects of natural history in fish-culture, bee-culture, &c.; and papers upon pomological and horticultural subjects, including the records of seven years, from 1864 to 1870.

Hon. William Parry, of New Jersey, in an address before the Pennsylvania Fruit-Growers' Society, expresses the opinion that only a very few varieties of the strawberry are required for profitable culture

in any given locality. He would have only enough to afford a uniform succession from the earliest to the latest ripening. Some varieties succeed remarkably in certain localities and with particular treatment, while in other places they would prove a failure. He has tested more than one hundred varieties, and come to the conclusion that it cannot be known whether a variety will succeed in a new locality till a trial has been made with it, and that no one variety is adapted to all soils and localities. He attributes the conflicting statements sometimes made about the productiveness of strawberries to the difference of soil and climate, and the treatment they receive. No variety within his knowledge has been more profitable to growers generally than Wilson's Albany. He has grown over 200 bushels per acre, which were sold at 10 cents per quart, amounting to more than $600. The Green Prolific, Agriculturist, and No. 30, are varieties which he has found to be very valuable. They are strong, vigorous growers, hardy, and productive. The last two are the largest strawberries grown, and, from their great size and attractive appearance, bring the highest price. In 1870 they brought $1 per quart, notwithstanding other good strawberries were plentiful and cheap. In cultivating strawberries or any other fruit for profit, he prefers to select those which will sell most readily and at the highest price, even if they are not in some respects so good as other sorts. He prefers to plant strawberries early in the spring, as soon as the ground is dry enough to be worked, plowing furrows previously two and a half feet apart, and putting into them a preparation of equal parts of marl, ashes, and ground bone. These substances must be thoroughly incorporated together in the furrow, and allowed to remain for ten to fourteen days, until the heat generated has softened the bone so that it will crumble like chalk when rubbed between the thumb and fingers. A mixture formed of one ton of each of these substances is sufficient for five acres. The strawberries set in it grow vigorously, sending up a luxuriant growth of dark-green foliage. Late in the fall he mulches the plants with stable-manure spread evenly over them, enriching the soil and preventing them from being thrown out of the ground by frost, and also keeping clean the growing fruit. The premium crop last year in Burlington, New Jersey, was at the rate of 263 bushels per acre, and yielded over $1,000 profit. The general average among growers in that State was only about one-third this amount of profit per acre.

Mr. Parry has not succeeded in open field culture of any of the foreign varieties of the raspberry in New Jersey. The climate is too dry for them in summer. He deems the Philadelphia the best variety; a hardy, productive, pale-red raspberry, adapted to all sections of the country. Its faults are a want of firmness and of bright red-color. A variety called the Herstine has lately been originated, which is said by the Pennsylvania Horticultural Society to have all the good qualities of the Philadelphia, with the addition of large size, firmness of texture, and bright-red color.

In cultivating the raspberry, he prepares the ground as for corn or potatoes, makes rows six feet apart, and sets the plants three feet distant in the rows, which requires 2,500 to an acre. The tops should be cut off within a few inches of the ground when the plants are set, that the roots may become well established before being required to supply nourishment for the other parts of the plant. The raspberry is liable to many accidents which injure the crop—as too high or low a temperature, or an excess of wet or dry weather. The yearly market-price is usually more variable than other kinds of fruit, so that a series of years must be taken to arrive at an estimate of the annual profit of the culture. He finds

from a review of the quantity of all the different kinds sold, good and bad, during the last ten years, that the average price is 23 cents per quart, which makes a net profit of about $284 per acre, 2,000 quarts being the average product. The expenses were $176: cultivation, $30; manure and use of boxes, $30; picking, $60; commissions, (10 per cent.,) $46; interest on value of land, $10.

After cultivating and testing twenty-six popular varieties of blackberries, besides a large number which were no better than the parent stock, he has been able to retain only four, which he regards as valuable for a field crop: Wilson's Early, Dorchester, Kittatinny, and New Rochelle. Their value ranks in the order given. Wilson's Early is the largest blackberry in cultivation, ripens early, closely following the raspberry, and therefore commands a high price. Two years ago he sold the principal part of his crop on ten acres for 50 cents per quart wholesale. A fruit-grower in West New Jersey, who had seventy-five acres in cultivation, sold the fruit last year for $20,000, realizing a net profit of $14,000. The Dorchester variety is early, and often grown in old apple-orchards with great success. A cultivator near Burlington, New Jersey, in 1864, planted two and a half acres of this variety in a peach-orchard, which was on light, sandy land. In 1865 the plants produced about enough fruit to pay for tillage, but during the next three years they yielded a net profit of $3,670. The Kittatinny is perfectly hardy, large, luscious, very productive, and profitable. The New Rochelle has been longer in cultivation than the others, but is now superseded by them. He considers blackberries among the most profitable crops, on account of their easy culture, hardiness, productiveness, and the high price for which they sell. They are not particular as to soil or location, and, with an occasional dressing of manure, they will continue to yield good crops for many years. On land suitable for corn they will average seventy bushels per acre. The land is prepared for cultivation as for corn, and marked with furrows eight feet apart, the plants being set four feet distant in the rows. Muck spread along in the rows before setting them is very favorable to their growth. The average yield for the past ten years has been 2,000 quarts per acre, which have sold for 15.6 cents per quart, making $312 income per acre, and leaving, after deducting expenses, a net profit of $200.

Mr. Parry regards the cultivation of the cranberry as one of the most profitable departments of fruit culture. The climate and soil of Burlington and Ocean Counties, New Jersey, are adapted to its highest development. These counties produce the greater part of the cranberries raised in the State. The most productive cranberry region is underlaid with white sand, much of it being pure silex. The soil is light, with a thin coating of vegetable mold covering the surface. Low, marshy lands and old ponds, which can be drained and flooded again at pleasure, will often yield annually $200 to $300 worth per acre. A fruit-grower in Burlington County recently cleared twenty acres of moist land, which before clearing, five years ago, was not worth more than $5 per acre, and planted it with cranberries. From two acres in full bearing and eighteen acres two years old, he realized, last year, (1870,) a net profit of $3,200. A farmer in the same neighborhood has two hundred acres under cultivation, about one-third of which is in full bearing, and yielded last year 3,300 bushels, worth over $13,000. Six acres averaged 100 bushels per acre, and sold for $4 per bushel. Another had twenty-four acres in bearing, six and a half in the tenth year and seventeen and a half in the first year of good fruiting, which yielded 2,692 bushels, and sold for $9,422. After deducting $2,222 for expense of raising

and marketing, there remained a net profit of $7,200. The six and a half acres in prime bearing yielded more than the seventeen and a half just commencing. The Forge Company in Ocean County cultivated about one hundred acres, fifty of which, being in bearing last season, yielded 3,400 bushels, and sold for $13,600. Three-eighths of this tract have been sold for $1,000 per acre. The number of barrels raised in Burlington and Ocean Counties last year was 38,300, being about 6,300 more than in 1869. The amount raised in the State was 50,000 bushels, about the same as in 1869, the want of increase being occasioned by the season.

Mr. Parry claims that few crops give so large and quick returns for the capital and labor required to grow them as the peach. A locality is rarely found which combines all the conditions necessary for its growth. They must, therefore, be supplied by the cultivator so far as they can be. A new peach orchard will not succeed well on the site of an old one. If the soil selected for an orchard is hard, it must be loosened with a subsoil plow; if saturated with water, it must be underdrained; if thin and poor, it must be enriched with proper fertilizing materials. Lime, ashes, and bone-dust are excellent. He sets his trees eighteen feet apart each way, in straight rows, at right angles to one another. Deep planting should be avoided. The trees should be set no deeper than they grew in the nursery, and the earth heaped up in a circle around them a few inches above the surrounding surface, with the top a little dishing, which will retain the rain, and allow the roots the full benefit of the surface-soil without being dried up. After the trees are planted, he cuts off the tops at a uniform height of three feet, and the branches within an inch of the body. They will then put forth young shoots, which will form low heads and protect the bodies from the scorching sun. The trees will also be less affected by high winds, and be more convenient for gathering the fruit. The ground may be planted with corn, potatoes, or vegetables for a year or two, till the trees come into bearing, after which it should be shallowly plowed several times a year with one horse, to keep the surface mellow and free from weeds and grass. A fruit-grower near Delaware City cleared, last year, over $16,000 from one hundred and forty acres. Another in Middletown, Delaware, had four hundred acres in peaches last year, and was offered $30,000 for the crop before picking, which he refused. He picked and marketed them himself, and cleared $38,000. The "Peach Blossom farm" in Kent County, Maryland, containing six hundred acres, and having four hundred acres cultivated with peach-trees just coming into bearing, was sold in the winter a few years ago for $31,500. The same year the purchaser sold peaches enough from it to amount to $52,000.

The business done on the Delaware Railroad and its branches, in carrying peaches, is immense. The freight on peaches sent over these roads to New York last year is reported to have amounted to $264,000. According to the official report, the total number of baskets of peaches taken from each station of the Delaware Railroad and its branches was 1,410,079, and about one-fourth as many more were sent by water. Of this number the State of Maryland furnished about 300,000. This crop was not quite so large as that of the preceding year, but the fruit was better grown, and the net profit about 50 per cent. more per basket. The average net price received per basket was 70 to 75 cents, and the net return for the crop shipped to market amounted to $1,125,000. Besides those marketed, large quantities were used at home for canning. Peach-growing is rapidly increasing in Maryland. In 1869 there were shipped over the Maryland Railroad two hundred and twenty-four car-

loads of peaches, and in 1870 two hundred and sixty-five, making an increase of 18 per cent., although the latter year was less fruitful than the preceding. Mr. Parry has grown more than seventy varieties of the peach, many of which he found to be of little value. He recommends the following, from which a selection can be made affording a succession of fruit from the earliest to the latest ripening: Hale's Early, Troth's Early, Mountain Rose, Large Early York, Crawford's Early, Old Mixon Free, Stump the World, Ward's Late Free, Harker's Seedling, Late Rareripe, Crawford's Late, Beer's Smock, Late Heath Cling, and Solway.

Mr. E. Satterthwait, of Jenkintown, Pennsylvania, in an essay upon pear culture, says he has made the cultivation of the pear a specialty, and found that he can attain the best results only by high culture. He gives his trees a liberal manuring annually with stable or barn-yard manure, and cultivates by plowing the ground alternately to and from them. His trees, though young, generally produce abundant crops, and the older they become the better they succeed under this treatment. He has never seen a pear-orchard in grass that was either thrifty or productive. If pear-orchards are seeded down with clover, other grasses will supplant it in two or three years, and the ground will have to be plowed. Mulching is generally found to be too expensive. He cultivates the spaces between the rows of his trees with gooseberries, currants, raspberries, rhubarb, and vegetables. His crops do well, and do not appear to injure the crop of pears, nor do the pear-trees seem to injure the crops growing near them, as do apple, cherry, and other fruit-trees. His trees receive no manuring or labor in cultivating them, except what is bestowed on the other crops; therefore the pear crop is almost a clear gain. He considers a northern exposure for a pear-orchard as objectionable, and strongly recommends protection from winter winds by hedges or other defenses. The Bartlett, Seckel, Lawrence, Duchesse d'Angoulême, and Beurré d'Anjou cover the greater part of the pear season, succeed well in most situations, are of indisputable excellence, and are indispensable in every collection. The Bartlett stands at the head of the list in its season, being first-rate in every respect.

Dr. Ellwood Harvey, of Chester, in a paper on horses, urges the importance of farmers giving more attention to selecting the best horses for breeding, and complains that, in choosing a stallion, they generally select from two or three that come within their personal knowledge, the difference of one or two miles in the distance to their stations often determining their choice of the horse from which to breed. He gives a history of the improvement of English horses, and alludes to the peculiarities communicated by noted strains of blood. Of the famous Percheron, he says that it originated from a cross of the Andalusian horse of Spain with the Norman horse of the south of France. The original Norman horse, as found in France, was large and somewhat slow and heavy in action. When the Spanish occupied the Netherlands, they desired for draught a horse as large and strong as the Norman, but of more spirit and activity. By crossing their own active Andalusian with the heavy Norman, they obtained the distinguished Percheron, which possesses the qualities sought. It is called Percheron from Perche, a province in France where it was largely bred. He credits the first importation of Percherons to Mr. Edward Harris, of New Jersey, in 1840. Both the Percherons and the thoroughbreds must be bred in the ancestral line to obtain the best results. When crossed with native mares, they usually deteriorate, and finally lose their original and desirable qualities. When Canada was first settled by the French, they brought

over the Percheron, and the Canuck, which has so great endurance, is a Percheron dwarfed by scanty fare and the rigor of the Canadian climate.

There is a crude notion prevailing that hardships make young stock hardy. A colt that is weaned in the fall, as is commonly the case, should not be allowed to become poor in its first winter. It is true that it will often improve so rapidly in spring that its wretched condition during the winter will seem really to have been an advantage to it, but this is a grave mistake. If the same conditions were imposed during the whole period of growth, the effect would be very perceptible. Although the summer may in some degree remove the effect of winter, no animal so treated ever becomes what it might have been in size, symmetry of form, and usefulness, by generous treatment. Dr. Harvey believes that there is profit in breeding nice carriage and draught horses. As a general rule, it costs no more to raise a good colt than a poor one, while the former will bring two or three times as much as the latter.

Mr. Seth Hoagland, of Mercer, in an article on bee-keeping, expresses the opinion that three-fourths of the bee-keepers allow their hives to remain through the winter on the stands where they stood during summer. The result of this treatment is that frequently many of the colonies perish, and those which survive are often so weakened that they are unable to lay up honey till the most favorable part of the season has passed. Besides these bad effects, the quantity of honey consumed by the bees during winter is much greater than it would be if proper care were taken of them. A uniform temperature sufficiently cold to keep them in a semi-dormant state throughout the winter is necessary. The thermometer should not fall below 32°, and never exceed 40°. This uniformity may be attained by protecting the hives on their summer stands, or by removing them to rooms properly prepared for the purpose. His apiary consists of one hundred colonies, which he winters from the 1st of December to the last of March, in a building sixteen by twenty-eight feet, well ventilated but perfectly dark, and having double walls all around, floor and ceiling, with a space of fifteen inches between the walls filled with sawdust. Whatever the room used, the foregoing conditions of temperature, darkness, and ventilation must be observed. With this care, a hive will consume only seven to ten pounds of honey during the winter; while, if left unprotected on its summer stand, it will require twenty-five to thirty-five pounds. A saving, therefore, of at least twenty pounds of honey is made on each hive, which, at 25 cents per pound, on an apiary of one hundred hives, would amount to $500 in one season, a sum sufficient to erect a suitable building. If sufficient natural pasturage is not found for the bees, it must be supplied. White clover, buckwheat, the linden-tree, golden-rod, and aster furnish good food. White clover and the linden-tree yield the best honey. Alsike clover is sown extensively for this purpose, and not only supplies honey for the bees, but hay and forage for farm-stock. It produces a great abundance of honey of fine quality, yields two crops of hay a year, and continues to bloom till the frost comes. The Italian bee is said to prefer it to white clover.

Mr. J. T. Rothrock, professor of botany in the Agricultural College of Pennsylvania, says that it was long ago noticed that wheat from France, when cultivated in Canada, needed to be acclimated before it would yield a good crop. Climate also has an important influence on the proportion of gluten and starch found in wheat. That grown in a warm climate has more gluten in proportion to the starch than that in a cold climate. This gluten contains a large quantity of nitrogen, which

serves to build up the muscular portion of the system. Starch contains a large quantity of carbon, which, with oxygen, is a generator of heat, and is especially needed by man in a cold climate. If a kernel of wheat is divided by cutting it crosswise, the outer coat will be found to be composed of the cellular tissue or bran; the next is the gluten, and the central portion the starch, which constitutes a large part of the kernel. In grinding, a large portion of the important element of gluten is often lost with the bran. Experiments prove that, in making a barrel of flour, there should be lost only about 10 pounds of innutritious matter, but, by the common process of grinding, the usual waste is 60 to 70 pounds, making at least fifty pounds of gluten to be cast away to inferior animals, which might as well have been supplied by cereals of less value to man. Wheat contains the largest amount of gluten in proportion to the starch when ripe. In an experiment made with Narbonne wheat, it was found that, when cut eighteen days before being ripe, it contained only 6 per cent. of gluten, but 12 per cent. when cut fully ripe. Since gluten is not so white as starch, it will follow that wheat cut a little before it is dead-ripe will make whiter flour than when cut at a later period, but it will be less nutritious and less in quantity.

RHODE ISLAND.

The Rhode Island Society for the Encouragement of Domestic Industry was incorporated in 1820, and now contains 1,256 life-members. The officers for the present year are William Sprague, president, and Joseph S. Pitman, secretary and treasurer. The permanently invested funds amount to $17,600. The labors of this society have been devoted to various branches of domestic industry, as manufactures, the mechanic arts, and the fine arts, as well as agriculture and horticulture. Mr. Royal C. Taft, of the committee on manufactures, has made some interesting investigations in reply to a letter of inquiry from Horace Capron, late Commissioner of Agriculture, on the origin of the woolen manufacture in this country. Mr. Taft says it appears that the first woolen factory in the United States was erected in Ipswich, Massachusetts, by Dr. John Manning, to whom the town granted the land for the building-site in 1792. The building was 105 feet long and 32 wide. For a few years broadcloths, flannels, and blankets were made, but, the manufacture not proving profitable, cotton was substituted. The first incorporated woolen factory in the United States was erected on Parker River, in Newbury, in 1794, in that part of the town called Byfield Parish. The goods manufactured were flannels and broadcloths. The first carding-machine was built at Pittsfield, Massachusetts, in 1801, by Arthur Scholfield, an Englishman, who came to this country in 1789 with Mr. Samuel Slater, the father of cotton manufacture in the United States. Mr. Scholfield also manufactured at Pittsfield the first broadcloth made in this country, in 1804. The cloth was gray-mixed. In 1808 he manufactured thirteen yards of black broadcloth, which was presented to James Madison, and from which his inaugural suit was made. President Madison, therefore, was the first President who was inaugurated in American broadcloth.

In November, 1870, this society proposed to persons pruning their grape-vines the novel plan of sending the surplus wood of early-ripening varieties to the secretary, Dr. William F. Channing, who offered to distribute the cuttings free of charge to all applicants. The undertaking proved successful. About seven thousand canes and cuttings of forty-two recognized varieties and three wild varieties were carefully labeled and distributed to several hundred applicants. All the best

varieties of early hardy grapes were included in the distribution, as well as some of inferior quality. The Isabella and Catawba were excluded on account of lateness in ripening, and also the Hartford Prolific, on account of inferiority in habit to others equally early. An effort was made to confine the distribution, as far as possible, to varieties ripening not later than the Concord, as the first condition of successful grape culture in this State. Verbal instructions were frequently given as to the best method of striking cuttings and of cleft-grafting pieces a few inches long on wild or other hardy grape-roots. The wood thus distributed contained at least 35,000 buds. Quantities of valuable productive material as great as that above named are wasted in every neighborhoood where vines are cultivated. The secretary says it is satisfactory to state that the free distribution of grape-wood has had the effect, in this neighborhood, of stimulating instead of diminishing the sale of grape-vines, the professional cultivator thus receiving equal benefit from the increased interest in grape culture. The recognized varieties distributed were the following: Ripening in August—Dracut Amber, Northern Muscadine, Nos. 1 and 2, Early Amber, Perkins; ripening from September 1 to 10—Rogers's Hybrids, Nos. 3 and 41, Eumelan, Brant, Hartford Prolific, Adirondac, Crevelling, Saint Catherine, Israella, Walter, Martha; ripening from September 10 to 20—Allen's Hybrid, Merritt, Delaware, Cleveland, Autuchon, Cornucopia, Canada, Sweet Water, (two varieties,) Madeleine, Iona, Rebecca, Rogers's Hybrids, Nos. 9, 5, 33, 22, (Salem,) 43, 19, 4, Clinton, Concord; ripening five days later than the Concord—Diana, Rogers's Hybrids, Nos. 1 and 30; ripening ten to twenty days later than the Concord—Ives's Seedling, Union Village, Diana, Black Hamburg, Catawba.

The society has directed its attention to entomology, and especially to the study of insects injurious to vegetation. The secretary says he has originated a simple method of preserving insects from destruction by parasitic enemies, by the use of carbolate of lime, strewed in the cases. Insects in the cabinet of the society, treated with this substance, have remained now about two years entirely unassailed, without even a renewal of the application. He states that this method has passed into common use, and, from the certainty of its effects, has removed one great objection to the collection of entomological cabinets.

SOUTH CAROLINA.

The proceedings of the annual conventions of the South Carolina Agricultural and Mechanical Society in the years 1870 and 1871, published under the direction of the secretary, D. Wyatt Aiken, show an increasing interest in the importance of diversified agricultural industry in that State. The changed system of labor and new conditions have rendered it imperative that intelligent cultivators should turn more attentive thought toward improved methods. The president of the society, Mr. Johnson Hagood, referred in his annual address to the fact that, under the slave system, labor was costly on account of its alliance with capital, and fatally limited in its supply to the natural increase of the small class from which it was drawn. Cherishing his costly and highly prized labor, which was also, under the laws of the land, the largest part of his capital, the whole effort of the planter was given to its increase, and the land bore the penalty of the favoritism—skimmed of its fertility, and thrown out to the recuperative efforts of nature, while the generous product of its virgin soil was invested in additional laborers, and the planter and his gang passed on to other

fields. Few buildings expected to last beyond the life of the tenant were erected; no fence which would not require rebuilding in five or ten years; and seldom was any ameliorating process vouchsafed to the soil. "New ground," in plantation parlance, was the equivalent of productiveness, and "old field" of sterility. Since emancipation, lands retain their favorable conditions of fertility, and are cheaper than they were before. Labor has lost its characteristic of capital, and has decreased in available quantity. Mr. Hagood presented some statistics, applicable to the lighter soils, and embracing the country below the falls of the rivers and above tide-water. In this region a man with a mule can well cultivate fifteen acres in cotton and fifteen in corn; allowing seven and a half acres for small grain, potatoes, &c., twenty-two and a half lying at fallow, and fifteen in wood-land, the amount is seventy-five acres. This, with the usual and necessary buildings and fences, will cost $750, the mule $150; about $80 must be added for wagons, plows, and other farm-tools, and $80 more will supply a cow, and the hogs necessary to consume the waste of the barn-yard. Therefore, $1,000 per mule is the amount of permanent investment necessary under the highest farming, and the most liberal treatment of land. Mr. H. is not in favor of dethroning cotton as the market crop. He says:

> It exhausts land less than any hoed crop we cultivate; it returns to the soil in its seed one of the best manures we can use, and, converted into meal, it is a most decided addition to the food-crop. Its compactness gives cotton, in transportation to market, advantages over all the other products of the plantation, and its cash value there makes it the true golden fleece. But, to avail ourselves of all the advantages we possess in this staple, the plantation should, as far as possible, be made self-sustaining, and the cotton product be the exponent of profit. Adopting this as the cardinal idea of our system, and realizing it as nearly as we can under the circumstances amid which each of us is placed, we will find our hoed crops decreasing in area, and, as their limits decrease, their products will increase. Instead of a bale to two acres, we will have two bales to the acre; and our corn and small grain-fields will experience the same changes. The lands withdrawn from these crops will be devoted to hay and pasture-fields, which yield their profits with but little outlay of annual labor.

In an essay on the most economical method of saving, manufacturing, and applying manures, Mr. Aiken says that to allow piles of cotton-seed to lie about the gin-house until they become offensive by partial decomposition, is indeed extravagance; and yet scarcely a plantation but presents such a scene. For cultivated crops at the rate of 30 bushels in the drill, or if broadcast, 50 bushels per acre, this manure will produce an increase of the crop worth double the cost of the seed. When green, it should be crushed to prevent germination. Seed can be most economically rotted by composting with stable, cow-house, or pig-pen manure, alternating layers of these, of the seed, and of leaves or straw, and allowing the heap to become thoroughly decomposed. One hundred bushels of green cotton-seed mixed in bulk with a ton of soluble phosphate, and allowed to remain about a fortnight, will make a capital compost for from six to ten acres of any cultivated crop. When the true value of cotton-seed is appreciated generally, it will be numbered among the manufactured manures, and never be applied in a green state. Concerning the rotation of crops adapted to what is called the middle country of South Carolina, Mr. Aiken says that red lands are more suitable for wheat than oats, and gray lands the reverse. Land too wet for cotton often produces abundant corn crops. He proposes the following rotation as one generally feasible and profitable, premising that the word cotton in the rotation signifies any cultivated or summer crop, as cotton, corn, sorghum, peas, or potatoes; the

word grain implies wheat, rye, oats, or barley; and clover means any grass:

First year	Cotton	Grain	Clover	Stubble	Stubble.
Second year	Grain	Rest	Clover	Cotton	Stubble.
Third year	Rest	Clover	Clover	Grain	Cotton.
Fourth year	Clover	Clover	Cotton	Rest	Grain.
Fifth year	Clover	Cotton	Grain	Clover	Rest.

Mr. Aiken recommends that in this rotation oats and barley should succeed cotton, wheat follow corn, and rye after sorghum. Clover will grow on any fertile land, but does better on thin, red land than on gray or sandy land. Orchard-grass does well on any fresh land, but may be choked out by crab-grass if sown in the spring. Timothy, or red-top, will grow well on the wet bottoms.

Mr. R. M. Sims furnishes an essay on grape culture, in which he forcibly urges that the climate and soil of the State are well suited to the growth of this fruit in perfection.

WISCONSIN.

The secretary of the State board of agriculture, Dr. J. W. Hoyt, has prepared an annual report of great value to the State, and calculated to benefit general agricultural interests. An illustrated paper on American butter factories and manufacture, by Professor X. A. Willard, of New York, is a prominent feature, in view of the fact that the dairying business is a growing industry in the State. The opening pages of the report present a carefully prepared statistical statement of the agricultural, manufacturing, and general business industries of the State, collated, for the most part from the United States census of 1870. The progress of agriculture is apparent from the increased number of persons devoted to the pursuit as compared with that of 1860, the increasing area and value of land in farms, and the statistics showing the actual production of successive decades. The areas devoted to agriculture, with their values, in the last three decades are stated as follows: 1850, total acres in farms, 2,977,158; value, $28,528,563; 1860, 7,893,587 acres; value, $131,117,164; 1870, 11,611,516; value, $300,-415,954. The increase of wheat production is shown to be in 1869, (census,) 25,323,647 bushels, against 15,812,625 bushels in 1859, the ratio per inhabitant exhibiting scarcely any change, being about 24 bushels per capita. The average value of the product of each acre in wheat for 1870 is stated at $12.06, representing in the aggregate $22,790,128.20. The secretary, however, suggests that although this in itself is a handsome sum, it is not so large a sum to realize from the laborious cultivation and gradual impoverishment of over two and a half million acres of land as to awaken great enthusiasm in the breast of any farmer. He urges farmers to consider the advantage of a more diversified system. The corn crop of 1870, the exact statistics of which are wanting, was the largest in ten years—in the aggregate the largest ever produced in a single year in the State—estimated at 20,000,000 bushels. Mr. Hoyt thinks that when the farmers of the State have learned that corn is not injured by barn-yard manure, and that deep plowing and thorough cultivation, even up to a much later day in the season than is commonly practiced, are sure means of increasing the yield, instead of ranking second, Wisconsin may come to take the very first rank in the product of corn per acre. There has been a notable increase in tobacco culture, about 1,000 per cent. since 1860. In 1850, the product in pounds was

1,268; in 1860, 87,340; in 1870, 960,213. The following is quoted from a leading journal of the State concerning the tobacco interest:

Last year the farmers of Rock county, who reside in the vicinity of the village of Edgerton, raised and sold more than $200,000 worth of tobacco, and this summer they have gone into its cultivation much more extensively than ever before. * * * The average yield per acre is about 1,300 pounds; but the best fields produced 1,800 pounds, and netted the producers from $100 to $250 dollars per acre. * * * It is estimated that the crop of this year, (1871,) which will be marketed in Edgerton, will be worth from $300,000 to $400,000. In other sections of the State we hear of many farmers who are engaged in its cultivation, but to what extent we are unable to say. In regard to the quality of the Wisconsin weed, we may state that at the fair held at Cincinnati last season some specimens sent from Rock county were considered superior to any Kentucky-grown article on exhibition.

The flax crop of 1870 was 497,398 pounds against 21,644 in 1860. There has been a marked falling off in maple-sugar and molasses production, but an increased amount of sorghum sirup, as appears from the following exhibit:

	1860.	1870.
Maple-sugar, pounds	1,584,451	507,102
Maple-molasses, gallons	83,118	31,218
Sorghum molasses	19,854	74,478

The ratio of increase in orchard products is shown as follows, exhibiting remarkable progress:

Value of orchard products in 1850	$4,823
Value of orchard products in 1860	78,690
Value of orchard products in 1865, (State census)	386,363
Value of orchard products in 1870	819,268

A growing appreciation of the importance of stock-raising is shown by the comparative statement of values of domestic animals in 1860 and 1870, in the former year $17,807,375, in the latter $45,310,882. The greatest rate per cent. of increase was in sheep, 300 per cent.

Cheese factories are springing up with great rapidity throughout the State, the number in operation, as far as ascertained, being 125. Statistics of 75 factories show an invested capital of $149,722; amount of cheese manufactured, 2,473,354 pounds.

The wool interest, a permanent one in the State, has made rapid strides. In 1860 the number of sheep was 332,954, yielding 1,011,933 pounds of wool. In 1870 the number had increased to 1,069,282, and the wool product to 4,090,670 pounds. Between 1860 and 1870 the number of woolen factories increased in number from 11 to 48, with a capital of $1,235,089. Total value of products, 1870, $1,094,858.

The amount of honey produced in the State during the year was 299,347 pounds. Mr. Grimm, the most extensive apiarian in the State, produced 22,725 pounds, selling at the average of 19 cents per pound, all expenses deducted. Mr. Grimm winters his bees in cellars, and loses not above 1½ per cent.

The estimated value of the farm productions of the State for the year 1870 is $78,027,032, against the estimate for 1860 of $36,336,498. The flour manufactured in the State in 1860 was valued at $11,510,834; in 1870, at $17,580,648.

The State Agricultural Society was never in a more prosperous condition. The annual fair was a great success. Total receipts of the society for the year, $23,495.23; expenditures, 9,717.77; cash premiums paid, $5,378.05.

The secretary, in concluding his report, refers to the fact that within the State there are more than a thousand cities and villages, embracing, with the country dwellings, nearly two hundred thousand houses; permanent agricultural improvements valued at nearly three hundred mil-

lions of dollars, besides stock and implements worth over one hundred and fifty millions; more than seven thousand manufactories, representing a capital of some fifty millions of dollars; over a thousand miles of railway; and a tonnage of some hundreds of thousands of tons of shipping.

At the annual State fair an address was delivered by Honorable Horatio Seymour, of New York, especially urging upon western farmers the importance of an increased interest in dairy husbandry. Noting the fact that cheese is the cheapest food in the world, Mr. Seymour said:

If you take the nutriment of a pound of cheese, and compare it with other food, you will see that it exceeds in nutrition any other article of food. You may sell a pound of cheese for something more than you would a pound of beef, but when you come to New York you will find that a pound of beef costs more than a pound of cheese. Therefore it is of great value to the population as an article of food; not only nutritious, but already prepared for use, and poor mechanical people will regard this consideration very highly. I do not hesitate, therefore, to say to you, farmers of Wisconsin, knowing, as I do, the physical character of your land, the diversity of your soil, and the geographical position of it, that you can safely engage in this business; that you need not fear that you will overstock the markets of the world. * * * In some respects you are the most unhappy people in the world. In the spring of the year you look forward and think it will not be good weather for plowing; then you think it will be ill weather for sowing, and then you watch the skies with the utmost solicitude; and thus all the year round you are perplexed until you have the products of your labor safely housed in your granary, and then you are the most unhappy people in the world before you can decide whether you will sell it or hold on. Now this unhappy state of mind we escape. We make cheese at our factories; it is sold once in thirty days, and we take what we can get through the year.

Governor Austin, of Minnesota, also delivered an address of an eminently practical character. He was impressed with the idea that there is too much sameness in the pursuits and occupations of western farmers; that there is great want of proper diversity; that too many people pursue almost fanatically a single branch of industry, which often leaves them to be overtaken by adversity and disaster. The condition of the people in Mexico, Cuba, South America, &c., was cited as illustrative of bad results from devotion to single pursuits—mining, sugar-making, cattle-raising, &c., being designated as their special occupations. In countries where this exclusiveness prevails, the people are illiterate, poor, and squalid generally, whereas in countries or sections where there is a diversity of occupation education, prosperity, and plenty are found. With the western farmer it too often happens that when one crop fails for any reason, he has nothing else to rely upon. While the western farmer enjoys a richer, finer soil, the eastern farmer makes better use of his means and resources, and therefore most frequently excels. It is bad policy, while we are trying to secure a livelihood upon our farms, to so neglect replenishing the chemical elements withdrawn from them by the removal of crops, as to impoverish and make them barren and unfruitful, so that the next generation will be obliged to spend years of toil and hardship in attempting to reclaim them to their original fertility. Farmers too often fail to keep the right kind of stock on their farms. Sheep are the best stock for enriching and reclaiming poor soils. As far as mutton is concerned the people of this country keep the poorest sheep in the world. The Englishman who visits this country and dines at the hotels no more calls for a plate of mutton than he would for a piece of roast dog. In England a good sheep is worth as much in the market as a yearling steer. Fineness of wool should not be the quality sought for. Again, Governor Austin very pertinently urged:

Another thing in the way of prosperity is the want of manufacturing establishments

in our midst. There is not a thrashing-machine manufactured in the State of Minnesota. Probably a million of dollars a year is paid out for agricultural implements, and but a very few are manufactured in the State. The consequence is that the country is drained of its money, which is carried off to other places, and paid for these things. Every farmer in Minnesota who buys one of Case's thrashers, manufactured in Racine, or others manufactured still farther east, pays eighty or ninety dollars freight on his machine besides profits and the cost of the machine. This want of manufacturing enterprise drains the country of vast sums of money.

In an article on cranberry-growing in the State, Mr. G. N. Smith states that the crop gathered the past season is probably a fourth larger than any former one, amounting to 33,000 bushels, or 11,000 barrels, yielding, at a low estimate, $120,000—after deducting expenses, leaving about $80,000 net to the growers. To realize the amount for which the cranberry crop sold in wheat, it would require 12,000 acres, averaging 10 bushels per acre, at $1 per barrel, or in apples it would require 40,000 barrels at $3 per barrel. The writer sums up the merits of the cranberry as follows:

Of all the fruit-bearing plants it is one of the hardiest, being unaffected by the extremes of temperature; it is the most prolific, yielding more to the acre than any other; after being established, it needs but little if any care, and does not require renewal; the fruit is popular everywhere, being the most esteemed where best known; it is less perishable, continuing the year through; it can be transported long distances without injury, and retains its long-keeping qualities in all climates; its health-giving properties are known and acknowledged, especially in all places were bilious diseases prevail. In this respect it stands unrivaled.

A writer on the cultivation of corn recommends that before planting, the corn should be soaked for twenty-four hours in water and then rolled in or thoroughly sprinkled with land plaster. In planting, only four kernels should be put in a hill. In heavy clay soil, if early in the spring, it should be planted near the surface of the ground, that it may not be out of the reach of the sun's warmth.

COLORADO TERRITORY.

The transactions of the Colorado Agricultural Society, for the years 1870 and 1871, have been published in a volume of 130 pages. This society, of which Mr. H. B. Bearce is president and Mr. Frederick J. Stanton secretary, was incorporated in 1864. Since then, at an expense of $36,000, it has purchased and improved for permanent use as fair grounds, forty acres of land located on the eastern side of the city of Denver. Among the improvements is a spacious hall for a cabinet of minerals, and for specimens of the fine arts and of fancy goods. Its collective cabinet, intended as a nucleus for future annual accretions, is very valuable.

In a brief report, the executive committee congratulates the society upon the impetus given to agriculture in the Territory through its agency. In the discussion of topics, they claim, first, that the "Great Desert Plains" are a myth of geographers, now being rapidly transformed into a grand panorama of pastures, perennial in nutrition, and free from the mildew, blight, foot-rot, and consumptive tendencies of the humid climates farther east, and of fields where grasses cure upon the ground without the necessity of cutting, stacking, and protecting from the rains of other localities. Second, that the uplands to which farmers are now turning their attention, are found to be as productive as the alluvial soils; that irrigation is generally feasible, is less expensive than underdraining, and secures against the drought and consequent famines to which the States depending on rains are liable. Third, that "pastoral agriculture" is fast becoming the great specialty of the Territory; that within the last two years many thousands of American cattle have been brought into it, the stock of which is being improved

by pure imported blood; that nearly every stock-man has his thoroughbred bulls, Durhams, Devons, Ayrshires, Herefords or Alderneys, and that every owner of a flock of sheep, whether merino, Cotswold, Southdown, or Leicester, is employing means to improve their blood. Fourth, that the planting of forest-trees is one of the most profitable of rural enterprises in the Territory; that as all the hard wood used is brought from the States, the planting of hard-wood forests will be especially profitable. The black locust is indicated as a species requiring less moisture than some soft woods, and growing nearly as fast, reaching in ten years a diameter of eight inches. The volume contains an address by Governor E. M. McCook, in which he discusses the same topics and presents similar claims with enthusiastic earnestness. He represents that "about the average yield throughout the Territory" is per acre: wheat, 38 bushels; oats, 55; corn, 30; potatoes, 150 to 200; onions, 250; beans, 30.*

In maintaining that the Territory is *par excellence* the pastoral country of North America, he alleges that its grasses are richer and more succulent than those farther south, affording, even in winter, better and more nutritious grazing; that, consequently, Texas cattle brought there increase in a single year, in size and weight, 20 per cent. As proof that the pastoral advantages of the Territory are becoming known, the governor states that nearly $1,200,000 were invested in herds during the spring and summer of 1870, principally by men who had been engaged in stock-raising farther east, but, under the conviction that Colorado affords greater advantages, had come into the Territory with the intention of making it their home.

Governor McCook claims that the ores of Colorado are richer than those of any other region on the continent, and that notwithstanding the very crude way in which the mines have, until recently, been worked, "they have yielded about $1,680 per year for each man engaged in mining or any other legitimate occupation in the mining districts." These statements necessarily rest on data so imperfect that they must be accepted as estimates rather than definite facts.

The following statements must be of interest and value to all farmers seeking light on the matters to which they pertain. Their correctness is vouched for by the society, and most of them are attested before a justice:

Tree culture.—Stephen H. Green, of Boulder County, has raised fruit and forest trees which, three years from planting, measured as follows: 1 Siberian crab, height 13 feet, circumference, 15½ inches; 1 apple, height, 9 feet, circumference, 10 inches; 325 black walnut trees, average height, 8 feet, average circumference, 7 inches; a cottonwood grove containing 4,312 trees, one and a half miles of cottonwood trees, planted closely for fence, and 231 box-elder trees, average height, 20 feet, average circumference, 25 inches. These trees, planted on upland second bottom, 10 or 14 feet apart, had been cultivated three years with corn between, and irrigated two or three times each season. Mr. Green is also growing chestnut, hickory, black locust, and honey locust trees. He states that a black locust grows 8 feet in a single year.

Grains.—Peter Magnus, of Arapahoe County, a prominent farmer in the Territory, sowed, between the 9th and 13th of April, 1870, on a field of 18⅝ acres, 12 bushels of Siberian wheat, plowed in the fall, harrowed in the spring, sowed with drill, rolled, and not irrigated. From one-third of this the yield was 300 bushels—about 48¼ per acre. In 1869, November 1, he sowed of Tappahannock wheat (the second year from the Department of Agriculture) 4 bushels on 5 acres, plowed once, harrowed twice, sowed with a drill, irrigated once in June, once in July, and harvested July 23; yield, 150 bushels—30 per acre. May 6, 1870, he sowed on 19 $\frac{5}{16}$ acres 19$\frac{5}{16}$ bushels of barley, plowed in fall, harrowed in spring twice, sowed with drill, rolled, and irrigated once—

* This estimate, particularly with regard to wheat, is undoubtedly quite too high. In every State, there are, each year, partial or almost total failures in some fields, which greatly reduce the general average, and Colorado is no exception to this rule.—[Ed. Rep.]

the last of June; yield, 700 bushels—about 36¼ per acre. About the 21st of April, 1870, he sowed on 7⅝ acres 4 bushels of excelsior oats, (second year from the Department of Agriculture,) plowed in the autumn, harrowed once, sowed with drill, rolled and irrigated once; yield, 232 bushels—nearly 31¼ per acre. In 1869, between the first and middle of November, he sowed on 10⅝ acres 10⅝ bushels of rye, plowed and harrowed once, sowed with drill, rolled, irrigated three times, and harvested July 18; yield, 250 bushels—a fraction over 23½ per acre.

In 1871 Mr. Magnus accompanied his exhibit of grains with statements so definite as to be models for others. The more important, abbreviated as far as possible, are here given:

Wheat; Tappahannock winter.—Raised it three years; seed, 1 bushel per acre; average yield, 30. Good, but not very profitable. *Siberian spring.*—Raised it three years; seed, 1 bushel per acre; average yield, 40. Very profitable; makes excellent flour. *Arnautka spring.*—Raised it five years; not profitable; will not make good flour; will not sow it again.

Rye; winter.—Raised it seven years; seed, 50 pounds per acre; average yield, 25 bushels; does well sown any time from September to March; very profitable for flour and feed. Every farmer having cows and calves ought to sow some acres in September for winter and spring pasture. Have done so, then mowed the same early in June for hay, and cut two and a half tons to the acre.

Oats; Excelsior.—Raised three years; seed, 50 pounds per acre; average yield, 50 bushels. Sown between April 1 and May 10. An excellent kind, well adapted to Colorado; grows fast and ripens early; the heaviest and plumpest heads he has ever seen. *Sweden black.*—Seed from Department of Agriculture. Raised it three years; seed, 1 bushel per acre; average yield, 60. Good oats, but not well adapted to this climate; of slow growth; will not sow them again. *Russian white.*—Seed, 1 bushel per acre; average yield, 45; good quality. *Common.*—Raised here eleven years with success. Seed, 45 pounds per acre; average yield, 40 bushels.

Barley; spring.—Raised it ten years; seed, 1 bushel per acre; average yield, 45. Excellent crop. Demand for it on the increase.

Peas; English field.—Raised them seven years; seed, 2 bushels per acre; average yield, 70 bushels. Excellent crop. Chopped, make splendid feed for horses and hogs.

Beets; sugar.—Very productive. Stand the hot weather better than any other thing growing.

On the whole, this modest record of transactions does credit to the young and vigorous Territory which the society represents, since it not only embodies strong testimony in favor of its great agricultural resources, enterprise, and thrift, but it is itself a creditable fruit and illustration of the same.

CURRENT RURAL PUBLICATIONS.

THE AMERICAN BOTANIST AND FLORIST.—Including lessons in the structure, life, and growth of plants, together with a simple analytical flora, descriptive of the native and cultivated plants growing in the Atlantic division of the American Union. By Alphonso Wood, A. M., author of the "Class Book of Botany," &c. New York and Chicago: 12mo, 564 pages; 1870.

This work furnishes the student in botany with a condensed manual of the science, within the compass of an ordinary duodecimo volume. It begins with aids to this study, descriptive of the different stages of plant life, with ample illustrations. This is followed by chapters on physical and systematic botany. Upwards of 300 pages are devoted to a description of the native and cultivated plants growing in the Atlantic division of the United States, in which are recorded and defined nearly 4,000 species, including all the known flowering and fern-like plants (excepting only the sedges and grasses) growing in the Atlantic half of the country. The work contains an ample glossary and index, and is handsomely printed and liberally illustrated.

MONEY IN THE GARDEN.—A vegetable manual, prepared with a view to economy and profit, by P. T. Quinn, practical horticulturist. Illustrated, 12mo, 268 pages. New York, 1871.

The author, who calls himself "a non-literary, practical man," unwill-

ing to "keep his own counsel and reticently go on, making what profit he may," or, "daily to answer a thousand and one questions by mouth and by letter," has briefly put into a book what he has learned from daily toil and the wisdom of other men. To these "simple and conscientious directions," given in a style "as matter-of-fact and explicit as possible," he refers the inquirers for his instructions on three distinct, although closely connected, branches of gardening—the kitchen, market, and field culture of root crops. As essentials to success, he names location and character of the ground, drainage, natural or artificial, deep tillage, and plenteous manuring. But to all these must be added experience, good judgment, and steady industry, to get the money there is in the garden. Of the soil he says:

> Almost any character of soil, with the exception of pure clay, can be brought up to a high state of fertility by adopting the proper methods; but, as in gardening, 'the early bird catches the worm,' and a week's difference in the time of ripening often makes a difference of from one to two hundred dollars in the gross receipts from an acre, the sandy loam will have the advantage over a heavy clay soil, even if they are equal in other respects.

For manurial purposes he enumerates stable manure, tanner's and soap-factory refuse, slaughter-house manure, sugar-house scum, wood ashes, and the various concentrated fertilizers, including fish guano. His compost of muck is made thus: dissolve one bushel of salt in the smallest quantity of water, slack three bushels of lime with it under cover, turning it over two or three times. To a cord of muck add one bushel of this lime mixture, and then a cord of barn manure, and in six months the compost will be fully equal to two cords of the best stable manure. In reply to the gardener's question, "How much manure can I use with increased profit?" he says, "If he is alive to his own interest he will soon discover that the quantity that can be so applied to an acre is large."

He treats of hot-beds and cold-frames; of the cultivation, harvesting, preservation, and marketing of crops; of seeds and implements, and, incidentally, of insects and remedies. He had offered $100 for a remedy against the insect (*Anthomyia brassicæ*) which produced "club root" in cabbages, and received a large number of recipes in reply—fourteen recommending lime in as many ways—all failures save one, which recommended one teaspoonful of caustic shell-lime to each plant, first "removing a little earth from around the stem, putting on the lime, and then replacing the soil. This method, with dusting the roots of the cabbage-plants with fine bone flour before setting them in place, has given me the best results." He promises to try the lime and the bone-dust *separately* another year, and publish the result. He adds, "there is no doubt in my mind but that lime does check the insect."

Of the new pest, the cabbage-worm, (*Pieris rapæ*,) he says that neither lime, fine salt, nor carbolic powder had any effect on it. "At last we mixed with twenty parts of superphosphate of lime, one part of carbolic powder, and three parts of fresh air-slacked lime. These were thoroughly mixed, and a small part of the compound thrown by hand into the head of each cabbage. This was repeated three times, with the most satisfactory results."

Of the boll-worm, (*Heliothis armigera*,) now invading northern corn-fields, eating the growing grain in the husk, he says: "The only remedy that we know of is to make small fires near the corn patch in the evening to attract the moths, and in this way destroy them before laying their eggs." Myriads of other pests would share their fate.

The larger portion of the volume is devoted to descriptions of the newest and best varieties of vegetables in use, their cultivation, &c. And it closes with treating of the forcing-houses, now coming into use near the large cities, a list of seeds, their vitality, quantity for planting an acre, and the number and distances of plants per acre. The illustrations of implements, structures, plants, roots, and insects are numerous and well executed.

EVERY WOMAN HER OWN FLOWER GARDENER: A handy manual of flower gardening for ladies. By Mrs. S. O. Johnson, ("Daisy Eyebright.") 148 pages square 12mo, New York: Office of the Horticulturist, 1871.

An earnest, sensible, much-needed work. "Having been an enthusiastic lover of flowers from childhood, and having cultivated them ever since the use of the hands was learned," the author writes from experience, and for a good and humane object.

American women live in-doors too much, and thus sacrifice their health and spirits. * * * This little pamphlet is written for the purpose of coaxing them to come out into the sunshine, and begging them to "list to nature's teachings." * * * I have little faith in American women becoming farmers—holding the plow, wielding the spade and shovel—but I do know from long experience that all the rest of the work can be accomplished by women, if they possess a love for the beautiful. * * * To dance the "german" requires quite as much physical strength as to plant a flower-garden and rake off the weeds; but that is the fashion, and beef-tea and stimulants must be resorted to, to sustain the feeble knees, and uplift the nerveless fingers. Women can find strength to cultivate a garden successfully if they will commence by degrees. * * * An hour, or even half an hour, is long enough for a commencement, and the next day extend the time ten minutes, and so on, until you can work for three or even six hours in succession. But take it easy. Provide an old piece of carpeting to kneel upon while planting or weeding with a fork; and if your knees are not accustomed to that position, humor them by placing an empty raisin or soap box upon the carpet and sit upon that; and if a cushion would also be agreeable, cover a small pillow with some dark chintz, and place that on the box. Now you will have a luxurious seat, and can garden without a sense of pain; yet, don't stay too long nor become much heated. The carpeting protects the skirts from the dampness of the soil, and should always be used.

After enumerating the implements needed, she writes: "With these implements every woman can be her own gardener, and not only raise all the flowers she may desire, but also contribute a large share of the vegetables that are always welcomed at the table during both summer and winter." Even the large kitchen garden, which should belong to every farm-house and many village dwellings, should have the mistress for overseer and director to secure proper taste, neatness, and to proportion its respective products to the wants of the household.

But flower gardening is the main theme of this manual, and as such gives full directions for laying out beds in garden and lawn; making arbors, rockeries, and trellises; selecting, planting, and cultivating all the varieties of bulbs, plants, vines, and flowers; for making up bouquets and filling vases; for preserving plants and seeds through the winter, &c., &c. And all this is written with such a love of the employment and its results, and interspersed with so many apt quotations from the poets, as to infuse not a little enthusiasm into her readers. The chapters on "Old-fashioned flowers," "Arrangement of bouquets and vases," (including "Flowers in churches,") and the last chapter, urging more general cultivation of a love for the beautiful, are specially interesting.

The following directions are given for the treatment of bulbs in window gardening: In October fill a shallow sauce-dish with sand, and set in it hyacinth (and other suitable) bulbs, and cover them with moss. Set it away for three or four weeks—till the bulbs root. Then place it in your window for sunshine and air, and about Christmas you will have a delightful fragrance and bloom above the green velvety moss. Of course, due heat and moisture must be supplied. As the flowers fade

new bulbs may be substituted for the old. Any tolerably deep dish will do, and it may be made with moss only.

MY SUMMER IN A GARDEN: By Charles Dudley Warner. With an introductory letter, by Henry Ward Beecher. 183 pp., 18mo. Boston: James R. Osgood & Co, 1871.

This book will not impart much information on planting, cultivating, or harvesting garden plants or products, but it will aid in erasing care-wrinkles from the heart and planting those of mirth on the face; and for this it may be commended to the families of hard-working farmers and gardeners.

The Rhododendron and "American Plants."—A treatise on the culture, propagation, and species of the Rhododendron, with cultural notes upon other plants which thrive under like treatment, and descriptions of species and varieties; with a chapter upon herbaceous plants requiring similar culture. By Edward Sprague Rand, jr., author of "Flowers for the Parlor and Garden," "Garden Flowers," "Bulbs," "Seventy-five Flowers." 12mo, 188 pages. Boston: 1871.

The object of the present volume is to introduce to popular notice a class of plants which, in England, forms one of the most attractive ornaments of the garden. They are commonly known as "American Plants," as the earliest known Rhododendrons, the Kalmias, and some of the Azaleas, are natives of this continent. The name has, however, been extended to embrace many other plants that require the same general culture, but which are not indigenous to America. * * * * There is a popular belief that these plants "cannot be cultivated." * * * * To show that these plants can be grown as easily as any others is the purpose in the following pages: The species we may find wild in our woods are beautiful enough to merit every attention, but we are by no means limited to these. The skill of the hybridist * * * has created a wealth of floral beauty in Rhododendrons and Azaleas. We may have masses of bloom of almost any color and shade, and combinations and contrasts innumerable. * * * * In flower they are magnificent; in foliage they excel every evergreen. They can be grown as easily as lilacs, and bloom quite as freely.

Of the two hundred and forty-four varieties described and classified in this book some are perfectly hardy; others require more or less shelter from cold north of Philadelphia; some are dwarf; others standard; some blossom with the crocus; others in July; many are profuse bloomers; some are fragrant; thus every variety of size, and continuous blossoming and fragrance for three months or more may be secured, even out of doors. For those who have but small space, the author gives lists—one, three, six, twelve, and twenty-four hardy kinds; eighteen kinds very fine, generally hardy; twenty-five kinds magnificent, require cellar shelter in winter; eleven kinds, late bloomers; nineteen new kinds, probably hardy; twenty-five kinds very distinct in variety, and thirteen which are standards. The European plants can be cheaply imported, and multiplied by cuttings and from seed, and varied by hybridization. Mr. Rand treats not alone of the large laurel, *(Rhododendron,)* and the laurel proper, *(Kalmia,)* and the wild honey-suckle or *Pfingsten blume* of the Germans, *(Azalea;)* the bed once prepared for these, you can easily cultivate the Labrador tea, *(Ledum,)* the heaths and the heathers, the trailing arbutus or Mayflower, *(Epigea repens)*—which "may also be raised from seed"—the checker-berry, the partridge or twin-berry, *(Mitchella,)* the cow-berry, *(Vaccinium,)* used like cranberries, the fragrant daphne—blooming twice, June and September—the winter-green, the pipsissewa; besides a number of favorite herbaceous flowers, as the lung wort, *(Hepatica,)* the tooth wort, marsh marigold, anemone, lily of the valley, the lady-slipper, moccasin or Noah's ark, *(Cypripedium.)* He closes his book by saying, "Indeed, a rhododendron bed is worth all the trouble of making, if only to show the perfection to which our native lilies can be grown." "They grow freely and, once planted, take care of themselves."

Mr. Rand gives a catalogue of illustrated works referred to by him, and a copious index for those who seek a special plant or subject. His preface—always the author's last words—closes thus: "To all who would obtain large floral results with but little efforts we would say—grow rhododendrons, and other American plants; they are always beautiful, pleasing alike in evergreen foliage and in gorgeous bloom."

1. A SIMPLE FLOWER GARDEN. For country homes. A practical guide for every lady. How to start it; what it will cost; how to stock it to have flowers the year round. By Charles Barnard, author of "My Ten-rod Farm," &c., 12mo, 76 pages. Boston: 1870.
2. Farming as a Profession; or how Charles Loring made it pay. By T. A. Bland, editor of the Northwestern Farmer; 12mo, 87 pages. Boston: 1870.
3. Five Thousand a Year, and how I made it in five years' time, starting without capital. By Edward Mitchell; 12mo, 125 pages. Boston: 1870.

These works form part of a series written to illustrate the attractions of country life, to inspire young people with a love for cultivating the soil, and show its possible rewards when resolutely and understandingly pursued. These lessons are inculcated in the form of pleasant narratives, though some may justly consider them romances. Mr. Barnard's book, however, professes to be of a strictly elementary character, with directions for managing house and garden plants through the year.

SEVENTH ANNUAL REPORT OF THE AMERICAN DAIRYMEN'S ASSOCIATION, with transactions and addresses at the annual meeting, list of members of the society, list of cheese factories, reports of factories, and other papers of value and interest. For the year 1871. Illustrated; 8vo, 187 pages. Published by the Association, Syracuse, New York.

SIXTH ANNUAL REPORT OF THE NORTHWESTERN DAIRYMEN'S ASSOCIATION, with addresses and discussions, at the sixth annual meeting at Elgin, Illinois, in January, 1872; 8vo, 99 pages. Published by the association, Madison, Wisconsin.

The first of these reports, in addition to the usual statistical material, embraces papers on the following subjects: The value of chemical analysis in dairy practice; the manufacture of condensed milk; poison cheese, and its causes; individual experience in making and marketing cheese in 1871; commercial view of the dairy interest; manufacture of butter in creameries; care of milk; the winter food of dairy stock; root culture and steaming food; and the just apportionment of milk values among patrons. The report of the Northwestern Association contains papers on grasses for the dairy; principles of breeding; condition and prospects of the dairy interest of the Northwest; size and shape of cheese, and the best methods of manufacture; besides varied information presented in the reports of discussions.

WILLARD'S PRACTICAL DAIRY HUSBANDRY. A complete treatise on dairy farms and farming; dairy stock and stock feeding; milk, its management and manufacture into butter and cheese; history and mode of organization of butter and cheese factories; dairy utensils, &c.; with illustrations. By X. A. Willard, A. M.; 8vo, 546 pages. New York: Rural New Yorker office.

Mr. Willard has long been known as a leading authority on matters pertaining to the dairy interest, and this volume embodies the fruits of many years of intimate acquaintance with the best methods pursued in this country and in Europe in the production of milk, butter, and cheese. The choice and management of land, the selection of stock, the situation and construction of buildings, the most profitable courses of feeding, the most approved processes of manufacture at the farm and the factory, are thoroughly discussed, and the numerous illustrations help to a complete understanding of the text. The work is of value to the general reader, as well as to the professional dairyman, from its comprehensive view of one of the most important fields of national industry,

whose products in milk, butter, and cheese have been estimated at $400,000,000 per year.

TRANSACTIONS OF THE VERMONT DAIRYMEN'S ASSOCIATION, 1870–'71. Embracing the addresses, essays, and discussions; 8vo, pp. 178. Published by the secretary.

Butter-making has long been the prominent specialty of Vermont dairying, and consequently a large proportion of this report is devoted to a consideration of the butter product. It is particularly valuable in presenting the experiences of practical dairymen of that region, pointing out not only the current errors in the management of this staple, but also the sure and profitable path to improvement. A few sentences from the addresses and reports of discussions will illustrate the earnest business spirit which characterized the conferences of the association. President E. D. Mason said:

Let us at this meeting resolve that the leading interest of our State shall be put in better standing in the markets of the country. There is no danger in overdoing the business, or overstocking the markets with a first-class article. The supply of good butter and cheese is far behind the demand. * * * It does seem that there is something wrong about the manufacture of butter and cheese in this community.

Mr. F. D. Douglas said:

Let it not be understood that I admit that we are behind the world around us in this matter. These remarks will apply to every other section of the country, with a few limited exceptions. * * * It is a matter of reproach to Vermont dairymen, that while a strictly prime article of butter will sell in Boston market for $1 per pound, the great mass of our butter sells for scarcely one-third of that. * * * The fact that our neighbors of Orange County, New York, receive nearly twice as much per pound for butter as we of Vermont, is just as much a reproach to us.

He claims that Vermont butter is of good quality, but that the want of uniform excellence reduces market quotations of the butter of the State; that the best prices would be paid for an article whose uniform good quality had given it a fixed reputation. That was his own experience in establishing a special brand; when he began to make really good butter, customers came to him, taking it at his own prices. He also claimed that the introduction of the manufacture of condensed milk, in dairy factories, would obviate a common objection to them, namely, that they did not use milk in the first part nor in the latter part of the milking season.

PRACTICAL HINTS ON DAIRYING, or Manual for Butter-making; by John P. Corbin, Whitney's Point, New York; 64 pp.

This manual, in addition to directions for butter-making, contains instructions for the erection and management of a dairy, and for the manufacture, packing, and marketing of good butter.

CATTLE TRANSPORTATION IN THE UNITED STATES: An essay, by George T. Angell, president of the Massachusetts Society for the Prevention of Cruelty to Animals. 7 pp., large 8vo. Boston: Published by the society, 1872.

This little brochure details the inhumanities inflicted upon cattle transportation in this country, and attempts to indicate the sanitary dangers threatening our people in the use of unwholesome meat. The authority of a wise law is invoked as the proper remedy for this growing evil.

THE HAND-BOOK OF HUSBANDRY: A Guide for Farmers, young and old. By Geo. E. Waring, jr., of Ogden Farm, author of "Elements of Agriculture," &c. Illustrated. 8vo, 604 pages. New York: 1870.

In this work Mr. Waring gives not only what he has learned from his own labors, but the recorded experience of numerous writers, for hundreds of years, on the fundamental principles of agriculture: "How the seed sprouts, the leaf shoots, the blossom unfolds, the fruit ripens; how

renewed life and vigor spring from death and decay; how fields are exhausted, and made fertile; how crops are increased, and kine grown; how, from only air and earth and water, such a marvel as man is made to live and move." His experience as a successful farmer has enabled him to separate the chaff from the wheat, or, at least, to select from the teachings of others (whether in the field or the study) information that the farmer will be most benefited by gaining. As some may affect to depreciate Mr. Waring's teachings with the cry of "book-farming," he says very pertinently that every sensible farmer will look with profound respect on the valuable aid rendered to agriculture by the discoveries of science, and by the practical application of these discoveries; and will consider in what particulars they have improved his own life. The book contains eighteen chapters, opening with a discussion of the question whether to buy or lease a farm; the commencement of operations; the key-note of good farming; fences and farm buildings; drainage; plowing, sub-soiling, and trenching; manures; rotation of crops; green, root, and forage crops; live stock; soiling and pasturing; medical and surgical treatment of domestic animals; the dairy, &c.; closing with a chapter of tables of almost daily use to the farmer and gardener. On the question whether to settle at the East or the West, Mr. Waring sums up the points as follows:

Let us suppose a young man, just married, to have a cash capital of $1,000, (and the same principles will hold good in the case of a smaller or much larger amount,) with which he purposes to commence farming. He starts in life with his own head and hands, the head and hands of his wife, and his $1,000 in money. His object is so to use these advantages as to get out of his life the greatest amount of good. The world lies before him for a choice. He can buy (with a mortgage) five or ten acres on the outskirts of a manufacturing town at the East, or he can have one hundred and sixty acres at the West for the taking. If he is the right sort of a man, he may grow rich, with the same amount of labor, during his whole lifetime, at either place. Fifty years hence he would have, at the West, a capital farm, well fenced, well watered, with good out-buildings, and with a good house. Probably he would also have his share of political honor and social distinction. At the East he would have glass-houses, hot-beds, rich lands for vegetables, a home with all the modern conveniences, and the most agreeable kind of work for the evening of his life. He would be less likely to achieve personal distinction; but, on the other hand, his wife would have, at least at the commencement, less drudgery, and his children better advantages for education near home.

These are the two extremes which are open to him, and his opportunities cover the whole ground between. It is for each man to weigh well the arguments on both sides of the case, and decide for himself, what no book can tell him, which promises the most of what he considers the most desirable.

In selecting a farm, of course a malarious district must be avoided, there being no curse like fever and ague. The size of the farm should be governed by the amount of one's capital. No man at the East is wise who goes in debt for more than fifty acres, especially with small means for the purchase of stock, implements, and manure. Fifty acres, brought to the highest state of cultivation, will produce more at much less cost than will one hundred only half so well cultivated. It is better to buy a farm run down, rather than a good one, even with good improvements, if they are not exactly what are required, (unless the improvements can be bought for much less than cost,) it being better to pay $50 an acre for a farm that $50 more will make exactly right, than $100 for a place that never will be exactly right. Lands abounding in swamps, rocks, and stumps are expensive to clear up, and delay legitimate farm operations. Farmers are apt to forget this, when they don't pay out money to have it done.

The place should be adapted to the sort of farming one desires to follow. Moist, cold soil is not suitable for the best fruit, nor high and dry lands for the best grass. If heavy manuring is required, a location

near a city or large town is desirable, where manure and other fertilizers can be hauled out. As the farm is to be one's home, the location should be pleasant, and the home attractive for the wife and children, or the latter will run away from the old roof-tree as soon as their age and circumstances permit, in the hope, at least, of a more agreeable life.

As the inquiries of many farmers and scientific men in other walks of life have been applied to finding out how plants grow, and what influence is exerted upon them by soils and manures, their experience having been published, a beginner should make himself familiar with their results in agricultural books and papers. Let neighbors ridicule him as a "book-farmer" if they choose, the condition of his farm, after a few years, will be a sufficient answer to those who have laughed at his habit of reading about farming.

That land should be made damper by being drained, and that underdraining should prove one of the best preventives of the the ill effects of drought, is the apparently anomalous proposition on which one of the strongest arguments in favor of draining is based. It seems hard to believe that a field baked to the consistence of a brick-yard, gaping open in wide cracks, and covered with a stunted growth of parched and thirsty plants, would be improved by the laying of hollow tiles four feet deep in the dried-up mass. For the first year not much effect would be visible; but in the next and all succeeding years, as long as the tiles continued to act, the most beneficial results would be visible. This baking and cracking, and the unfertile condition of the soil, are the result of a previous condition of entire saturation. Clay cannot be molded into bricks, nor dried into lumps, unless it is made soaking wet. Dry or only damp clay, once made fine, can never again be made lumpy, unless made thoroughly wet, and pressed together while in that condition. Neither can a considerable heap of pulverized clay, kept covered from the rain, but exposed to the sun and air, ever become even apparently dry, except within an inch or two of its surface. Underdraining, after it has had time to bring the soil for two or three feet to a thoroughly well-drained condition, prevents its becoming baked into lumps, or too dry for the purposes of vegetation. The water of heavy spring rains, instead of lying soaking in the soil until the rapid drying of summer bakes it into coherent clods, settles away, and leaves the clay too much dried to crack into masses. There are many farms on which fields termed "naturally cold," "heavy," "sour," "springy," cultivated year after year, under heavy disadvantages, with half-crops, heavy labor, and "catching" work, that could be rendered warm, mellow, and fertile by judicious drainage. After describing the various operations connected with tile, stone, plank, brush, and pole drains, and the comparative cost of each mode, he claims that the following advantages will result from a thorough system of tile-draining: 1. It greatly lessens the evil effects of drought; 2. It enables the soil to receive a larger supply of the fertilizing gases of the atmosphere, (carbonic acid and ammonia;) 3. It warms the lower portions of the soil; 4. It lessens the cooling of the soil by evaporation; 5. It greatly facilitates the chemical action by which the constituents of the soil are prepared for the use of plants, and by which its mechanical texture is improved; 6. It tends to prevent grass lands from "running out;" 7. It deepens the surface soil; 8. It renders soils earlier in the spring, and keeps off the effects of cold weather longer in the fall; 9. It prevents the throwing out of grain in winter; 10. It enables us to work much sooner after rains; 11. It prevents land from becoming sour; 12. It lessens the formation of a

crust on the surface of the soil after rains in hot weather. All these positions are illustrated in detail.

In his chapter on plowing, subsoiling, and trenching, Mr. Waring states that England, with fewer land-holders than the State of New York, and with nearly all her farmers working leased land, has about eight hundred steam-plows and cultivators in active use, cultivating not far from 300,000 acres. The system of general steam cultivation has there been an established success for a dozen years, succeeding in spite of numerous impediments, in the way of small fields, uneven surface, and crooked fences. It must soon get a foot-hold on the farms of our western prairies, where every circumstance that can promote its efficient application seems ready-made.

Mr. Waring devotes about eighty pages to the subject of manures, giving the results of many years of study and speculation, as well as of experiments. As to the relative value of the droppings of different animals, those of fowls are considered the most concentrated and active of all manures produced on the farm, as they live on the most concentrated and richest food, namely, seeds and insects.

In raising wheat the following points are presented, with the opinion that their careful observance will increase the general average yield from twelve to twenty-eight bushels:

1. The land may with advantage be made as rich as possible, (the application of fresh stable manure in the immediate preparation for the crop being avoided.)
2. It should be thoroughly drained, either naturally or artificially.
3. The seed should be selected with care, and of the sort that is most likely to succeed in the climate and soil of the locality.
4. The seed should always be drilled, rather than sown broadcast.
5. The ridges made by the drill should not be leveled by the harrow or roller until after the ground has settled in the spring.
6. The amount of seed should be from one bushel, or even less on very rich land, to two bushels on the least rich on which it will pay to grow wheat.
7. Wherever sufficient help can be obtained it will probably pay to hoe the crop early in the spring; it will certainly pay to remove all weeds growing among it.
8. The crops should be cut from ten days to two weeks before the grain is thoroughly ripe.

He assumes that "sowed corn" as a forage crop produces more feed on a given area than any other plant, unless it is sorghum. During the intense heats of summer it grows (on rich and well-drained land) as nothing else will, affording during August and September a luxuriant supply of the very best food for all animals not kept for work. Even swine will thrive on it, while for milch cows it is unequaled by any other food, largely increasing the flow of milk. It should be sown in drills three feet apart, so that they can be worked out with the cultivator. Next to Indian corn he thinks there is no forage crop equal to red clover. Considering its effect on the land, it should rank first; for while Indian corn requires rich land and ample manuring, clover, striking its feeders deep into the earth and finding nutriment where the shorter and more delicate roots of cereals never go, is the most fertilizing crop grown, and may justly be called the poor man's manure. He also recommends rye and millet as forage crops.

Mr. Waring gives his experience in soiling about thirty animals, old and young, on his farm, near Newport, Rhode Island. The place had but recently come into his possession, after years of leasing and skinning, and was in too poor condition to show the best effects of soiling. The results convince him that in a very few years he will be able to feed a full-grown animal abundantly from the product of a single half acre, during the whole season, from the middle of May to the middle of November. He thinks that the increased production from one year to

the next will be in constantly growing proportion, the fertility of the land being improved not only in the ratio of the amount of manure applied, but also of the number of cultivations, and by the absence of the injurious effect of the feet of animals pasturing upon it. In feeding twenty cows, the extra labor of manuring, planting, cutting, and feeding would require during six months of the year the services of one man and one yoke of oxen; but the following facts are to be considered: 1. The man and team employed for the soiling work can render valuable assistance at harvest time, or whenever the work is hard, and will regularly do much outside work. 2. The condition of the animals will be much better than when pastured in the field. 3. The product of milk will be larger. 4. The chance that butter, cheese, or milk will have its taste affected by wild onion and other high-flavored weeds will be prevented. 5. The time wasted and the derangement of farm-work necessitated by driving cattle to and from the pasture will be obviated. 6. The fertility of the farm will be incalculably increased by the immense accumulations of the very best of all manures. Land which this year will soil twenty head of cattle should, five years hence, soil at least thirty under the same general treatment, while it will have been raised to such a condition of fertility that it may be repeatedly cropped with grain, with the certainty of the very best results.

In the management of dairy cows, these general principles are suggested: 1. The cow should be constantly kept in a thrifty, healthy condition, and with a voracious appetite. The great end of her life, the production of milk, cannot be accomplished unless she is comfortable and cheerful, and unless she consumes the largest amount of food that it is possible for her to take into her stomach without injury to her health. 2. The character of the food should conform to the end it is desired to attain; if for milk to be sold, to stimulate the production of *quantity* and, incidentally, to induce the drinking of a large amount of water, while for making butter the food should be less watery in its character, and much richer in *quality*. 3. Pregnant animals, in addition to the demand which the secretion of milk makes upon their digestive organs, require a certain quantity of food, and food of the most nutritious character, for the development of the fœtus. 4. The stock should be so fed that the manure heap be made as rich as is consistent with profitable feeding.

In a chapter on steamed food Mr. Waring remarks that after two years' experience he thinks that one-third of the food is saved by steaming, and he is sure that corn-stalks that have molded in the stack, musty oats, cut green and badly cured, and smoky hay, (nearly the whole of which would be rejected if fed uncooked,) are eaten with avidity if cooked, and with evident benefit to the stock. There is no advantage in steaming roots; there is a freshness about them in their raw state that is perhaps beneficial, and certainly very acceptable to stock.

WHAT I KNOW OF FARMING: A series of brief and plain expositions of practical agriculture, as an art based upon science. By Horace Greeley. 335 pp., 12mo. New York: G. W. Carleton & Co. 1871.

This work was originally published in the New York Tribune in weekly chapters. Mr. Greeley writes "mainly for beginners—for young persons, and some not so young, who are looking to farming" as their vocation, in the hope of arousing a spirit of inquiry which will lead on to the perusal and study of profounder and better books. His qualifications, aside from his experiments on his farm at Chappaqua, are the experiences of a laborious boyhood on the rugged, stony soil of a New Hampshire farm and on a forest-covered one in Western New York, supple-

mented by reading, conversations and observations of diverse soils and systems of farming in Europe and America.

He opens with the question, "Will farming pay?" and proves by many instances and statements that it *will* pay, on the average, as well as the trades and professions. But, as in other vocations, there is good and bad, and it is *good* farming that pays. He assumes that "the fairest single test of good farming is the increasing productiveness of the soil."

Chapter 3—"Where to farm"—states the conditions which should determine the answer. Though he favors migration, (West or South)—especially co-operative migration—he says emphatically:

He who has a farm already, and is content with it, has no reason to ask, "Whither shall I go?" and he may rest assured that thoroughly good farming will pay as well in New England as in Kansas or in Minnesota. I advise no man who has a good farm anywhere, and is able to keep it, to sell and migrate. * * * * If you have money to buy and work it, and know how to make the most of it, I believe you may find land really as cheap, all things considered, in Vermont as in Wisconsin or Arkansas.

Chapters 4, 5, and 6, on "Preparing to farm," "Buying a farm," and "Laying off a farm," are specially instructive for a beginner, who is cautioned to make "no haste," but to acquire that first, greatest prerequisite, *experience*, even if he must gain it by hiring as a laborer on some well-managed farm. Such apprenticeship, and the study of good agricultural works, will furnish capital for purse, hands, and brain. In buying, the almost certainties of future production must be regarded, that burdensome debt may be avoided. The wealthier beginner is told to buy just so large a farm as half his means will pay for; but he is advised that the farmer has too much who allows any portion to lie idle and unproductive. As to size, while not a believer in "ten acres enough," Mr. Greeley thinks there are few who are able to manage a large farm well. He advises the beginner to study well the character and capabilities of each acre, and plan how to make the most of it "before he cuts a living tree or digs a solitary drain," and says: "I would devote at least a year to this thoughtful observation and study." He is opposed to pastures, generally, as cattle eat the best grasses and allow coarser kinds and weeds to run to seed and increase. But, if any, the pasture lot should be small and central, so as to be easily supplied with additional feed and provided with shelter.

Besides frequent incidental mentions, he devotes chapters 7, 8, 9, and 23 to the planting of forest-trees of the most valuable kinds, as shelter belts, to occupy rugged, steep, and stony places, and for other useful purposes.

Utility (he says) is the reason and end of all vegetable growth—of a hickory's no less than of a corn-stalk's. I have always considered "Woodman, spare that tree," just about the most mawkish bit of badly versified prose in our language, and never could guess how it should touch the sensibilities of any one. Understand, then, that I urge the planting of trees mainly because I believe it will *pay*, and the preservation, improvement, and extension of forests, precisely for that reason.

Even of level, tillable land he would have one-fourth wooded, and all other lands he would cover *thickly* with the best trees, to be thinned out for poles, &c., from year to year, to the greatest profit; while, on the great western plains, he would have quarter-sections, and even square miles, thus covered for shelters and market purposes. He says:

Were all the rugged crests and rocky acclivities of this county (Westchester, New York) bounteously wooded once more, and kept so for a generation, our floods would be less injurious, our springs unfailing, and our streams more constant and equable: our blasts would be less bitter, and our gales less destructive to fruit. We should have vastly more birds to delight us by their melody, and aid us in our not very successful war against devouring insects; we should grow peaches, cherries, and other delicate fruits, which the violent caprices of our seasons and the remorseless devastations of

our visible and invisible insect enemies have all but annihilated; and we should keep more cows, and make more milk on two-thirds of the land now devoted to grass than we actually do from the whole of it. And what is true of Westchester is measurably true of every rural county in the Union.

What he says of draining, incidentally, and in chapters 10 and 11, (including what he calls "my blunders,") of irrigation, in chapters 12, 13, 44, and 46, is instructing and suggestive.

He writes of birds as follows:

If I were to estimate the average absolute loss to the farmers of this country from insects at $100,000,000 per annum, I should doubtless be far below the mark; I have no doubt that our best allies in this inglorious warfare are the birds. They would serve us if we did not destroy them. * * * * The boy who robs a bird's nest is robbing the farmer of a part of his crops. * * * * The farmer might as well consent that any strolling ruffian should shoot his horses or cattle as his birds.

The chapter on "sheep and wool-growing" contains a merited anathema against dogs, and recommends protection against them. "Co-operation" in emigration, in the purchase of expensive farm-implements, in fencing, and in other matters of common interest is set forth in chapters 40 and 42; clubs for farmers and their *families*, in 43; and the use of sewage for fertilizing crops in chapter 45. We close with an abstract of his "summing up," chapter 52:

1. Good farming pays—no business is more certain to be profitable.
2. No farmer should occupy more land than he can manage profitably.
3. The beginner should select his location carefully, and once for all.
4. No one should engage in farming for himself without previous training on the farm.
5. Prefer a small farm, without debt, to a large one with it. There will always be land for purchase when you have earned money to buy it.
6. Avoid much pasturing, and, when land is worth $100 per acre, resort to soiling.
7. Good timber on rough or rocky land will pay better than grass, and should be *cut out*, rather than *cut off*.
8. Underdrain lands that retain wet, beginning with the wettest, and one field or portion at a time.
9. Wherever water can be retained and led for irrigation at moderate cost, try it; first on the probably most profitable slope.
10. Mr. Greeley found gypsum, shell lime, and ground bones certainly profitable, and advises experiments with these and other fertilizers, and a large use of muck, &c.
11. Shallow culture is the great defect of American farming. Subsoil, if possible; but each year plow a little deeper.
12. Read and study good agricultural books, and interchange thoughts and knowledge thus obtained in frequent conversations with your neighbors, and you will live longer, and to better purpose, and leave more property and a better example to your children.

Manual of Agriculture for the Southern United States. By Major E. G. Wall, of Mississippi, practical planter. 254 pages. Memphis: 1870.

This manual is presented by the author to the people of the Southern States, to which latitude it is particularly adapted. The book indicates an awakening in the South to a greater interest in an occupation for which that section has some advantages over those portions of the Union that are locked up for several months by the severe frosts of autumn and winter.

The first and most important southern crop, according to this manual, is Indian corn; the second, generally considered the agricultural staple of the South, is cotton. The author refers to the introduction and development of cotton culture, and states that in 1784 the first

shipment of eight bales was seized by the custom-house officials at Liverpool, it not being believed that even the small quantity of 2,000 pounds had been raised in the United States. The sea island variety is confined to a very few plantations on the sea-board:

It is superior to all others in the length and fineness of the staple. It bears a high price, generally thrice as much as the best uplands, but from its expense of preparation for market is not considered more profitable to cultivate than the short staple. The Mexican is now chiefly cultivated, having displaced nearly all other varieties. The introduction of the seed into the United States is curious. The Mexican seed is believed to have been first introduced by the late Walter Burling, of Natchez, Mississippi. He was sent to Mexico on a mission in 1806. He requested permission from the viceroy to import some Mexican cotton-seed, a request which was not granted, on the ground that it was forbidden by the Spanish government. But the viceroy sportively accorded his free permission to take home with him as many Mexican dolls as he might fancy, a permission well understood and freely accepted. Mr. Burling had these dolls stuffed with cotton-seed.

The diseases of the cotton-plant are given, the most approved remedies, and a description of insects beneficial and injurious to it, with the best plan of ridding the fields of those which are injurious. Another chapter is devoted to planting, cultivating, and gathering the crop. "The best cotton-lands are those which are of a deep and soft mold, a sort of medium between the sandy and the spongy, and those soils which are hard and close. The soil should be prepared by throwing the lands intended for cotton into beds, made by the turning-plow; and on flat and wet lands sometimes an additional elevation ought to be made by drawing up the beds with a hoe." The distance should be such that "when the crop is at maturity the branches of the plant may slightly interlock every way;" much depends upon the fertility of the soil, rich soils requiring wider planting. The rows ought ordinarily to be three and a half to four feet apart in medium lands of the country, and the stalks in the drill should be thinned so as to stand twelve to twenty inches from each other. The width of the rows and the distance in the drill may be increased in better lands. The rows should run in such direction as to give the plant the greatest benefit of the sun from early morn to its setting. "Cotton is decidedly a sun plant." Directions are given for thinning out, weeding, and cultivating, and the injunction to keep the grass and weeds down is duly emphasized. "It is of great importance to work the crop late, and it should not cease until the branches lock or the cotton begins to open."

Directions are given for the cultivation of the various kinds of grain and of the grasses, and the suggestion is made that every farmer should make repeated experiments on his own lands with various kinds of grass, that he may determine which are best adapted to his soil. He advises the farmer never to allow a field to be out of clover or some kind of grass, when it is not occupied by other crops, and never to neglect an opportunity of plowing under clover or grass sod as the cheapest way of enriching soil.

He states that sorghum thrives with great luxuriance in the rich bottom-lands or in moist, loamy soils well manured; endures cold and drought much better than corn, and resists without injury slight frosts in the fall; in Virginia and other Southern States it seeds in October when planted by the 20th of June. At the extreme South it may be planted from January to July. He states that the height attained varies from six to eighteen feet in the Southern States. He estimates the weight of the crop of cane at ten to forty tons per acre; the seed produced at fifteen to sixty bushels; yield of juice from well-trimmed stalks, 50 per cent.; gallons of juice to a gallon of sirup, five to ten; yield of sirup per acre, one hundred to four hundred gallons; yield of

alcohol, 5 to 9 per cent. He refers to the value of sorghum for cattle forage, and states that a capital bread can be made of flour from the seed.

AMERICAN MANURES, AND FARMERS' AND PLANTERS' GUIDE. By James Bennett Chynoweth and William H. Bruckner, Ph.D. Philadelphia: Chynoweth & Co., 1871.

This work treats of a subject which demands, at the present time, a thorough investigation. It contains seven chapters, three of which are devoted to plant-growth and the soil materials needed in that process, and three to soils and manures. The remaining chapter gives the results of the analysis of some fifteen different fertilizers.

The authors manifest a fair acquaintance with the subjects of plant-growth and its relation to soils. The chapters on these subjects contain much information useful to farmers. We think, however, that the view taken of soil analysis is too mechanical, and the importance attached to it likely to mislead. Take an example from page 105. Speaking of analysis, the writer says:

> This would be analogous to taking an account of stock by the merchant or manufacturer, only it need not be done so often. After once acquiring this knowledge the farmer may easily estimate the amount of various substances removed by different crops, as well as what he has added in the shape of manures, and so arrive at a knowledge of the true condition and real value of his lands.

If the chemical composition of the soil were the only condition of fertility, this view would be correct; but as it is only one of the conditions, it can hardly fail to misdirect those who are led by it.

The analyses were made by Dr. Bruckner, and they appear to have been carefully performed. The following-described method of testing samples is worthy of notice:

> Packages already put up for sale to the farmer were purchased from the manufacturers or their agents. Each package was opened as soon as it arrived at our office, in the presence of witnesses, its contents thoroughly mixed, and a sample of about five pounds taken from at least fifty places of the thoroughly-mixed heap, thus guarding against varying quality in the mass.

The estimate of value which is appended to each analysis may be criticised with an evident show of justice. In the first place, no allowance is made for the labor of compounding the mixture nor for the interest of the capital employed. In the next place, the demand for bones to be used in this business has greatly advanced the price of the soluble phosphoric acid, which can hardly be furnished now at 12½ cents per pound; 15 cents would be nearer the present cost. The mode of estimating and valuing phosphoric acid is open to the charge of unfairness. To give *no value* to phosphoric acid insoluble in rain-water is evidently unjust. If bone-dust be made fine, it will, after a few years' exposure to atmospheric influence, yield an appreciable amount of phosphoric acid to growing plants. Its value should therefore be placed above zero. Four or five cents a pound would, perhaps, be a fair estimate. But there is another and an important fact which appears to have been entirely overlooked in these estimates. It is well known to chemists that soluble phosphoric acid in the presence of bases enters again into combination with these and becomes insoluble in rain-water, but at the same time may be readily dissolved by ammoniacal compounds. It will be very unfair to give this *reverted* acid as *insoluble*, and therefore of no value. On this subject Dr. Voelcker, the chemist of the Royal Agricultural Society of England, speaks thus:

> I have long been familiar with the fact that a newly made superphosphate, though richer in soluble phosphate of lime than will usually be found after keeping three or four months, does not act as beneficially in the field as the latter. It is, therefore, plain that a superphosphate which, in keeping, *has gone back, has not* really become depreciated in value.

Making allowance for minor defects, we regard American Manures as a book evidently leading in the right direction, and one from which the practical farmer will be able to collect a store of valuable facts and suggestions.

AGRICULTURE: Twelve lectures on agricultural topics, delivered before the Lowell Institute, Boston, Massachusetts, by Alexander Hyde. 12 mo, 372 pages. Hartford, Connecticut: American Publishing Company, 1871.

These lectures were published in the Springfield Republican, and now appear in book-form, embellished with eight engravings of colleges, cattle, &c., and each lecture divided into suitable chapters.

The first lecture, "Agriculture as a pursuit," places the farmer in the foremost rank of society. The second embraces the history of agriculture from the earliest ages to the present period. Both range on a wide field of general as well as special interest. The third lecture on the soil, gives a geological and chemical view of the origin and constituents of the various soils. The following mode of determining the constituents of any soil is presented:

Dry the soil thoroughly on a piece of paper in an oven, the heat of which is not sufficient to brown the paper. The loss in this process of drying gives the amount of water. If the loam is now placed on a shovel which is heated to a red-heat, the loss will indicate the amount of organic or vegetable matter, and the balance will mainly be sand and clay, and the proportions of these can be ascertained with sufficient accuracy for all practical purposes by boiling in water and allowing the sand to settle to the bottom, which it soon does, leaving the clay in a state of mixture with the water. When this is poured off, the sand can be dried and weighed. The weight of the sand subtracted from that of the sand and clay together gives the weight of the latter. This process gives only the four principal constituents of the soil, and makes no allowance for the lime, soda, magnesia, iron, &c., which must enter more or less into the composition of all fertile soils.

Lecture fourth, on farm drainage, gives a history of the practice; quoting Walter Bligh's *rationale* of thorough draining, in 1650: "The goodnesse of the water is, as it were, riddled, screened, and strained out into the land, leaving the richness; and the leanness sliding away from it." The benefits of draining are stated: 1. The cold and sour standing water, which drowns vegetation and packs the soil, is filtered through. 2. By this filtering the manurial portions of the water are left in the soil. 3. The soil being thus opened, the aerial gases (especially oxygen) enter it, and decompose the organic matters, so that they can be taken up by and nourish the plants. 4. By lessening the evaporation and opening the soil to admit the air and warm rains, (in place of cold standing water,) the temperature of the land is raised. 5. It equalizes the temperature, and prevents sudden changes of heat and cold. 6. It renders the soil drier and warmer early in the spring and later in the fall, thus greatly prolonging the planting and growing season. 7. In dry seasons the soil is moistened by condensation from the air admitted into it, not only from above, but also from the drains beneath. 8. The soil thus made more open and mellow, roots penetrate farther and get more nutriment. 9. The open, dry soil absorbs miasmatic gases, which enrich the soil and purify the air, increasing wealth and health. Foot-rot and other diseases of animals decrease on drained lands. 10. Grasses improve in kinds, quality, and quantity; the finer and richer supersede the coarse, sour kinds; the greenness is made more enduring, as the season of growth is prolonged. Emerson's playful argument is quoted:

By drainage we have gone to the subsoil, and we have a Concord under Concord, a Middlesex under Middlesex, and a basement story of Massachusetts more valuable than all the superstructure. Tiles are political economists. They are so many young Americans announcing a better era—a day of fat things.

In lectures 5th and 6th, on fertilizers and vegetable and animal manures, he holds, with all intelligent agriculturists, that "every bushel of grain, every cheese, and every ox sold must carry off more or less of the salts of the soil. * * * * Lands naturally rich may endure this process for a series of years and not show much deterioration, but exhaustion must follow sooner or later where more is given than is received." He notices also a "quite frequent mistake of the cultivator * * * * supposing that some one specific manure is an equivalent for the many elements of fertility which the crops carry off. * * * * Barn-yard manure, especially where roots and grain, as well as hay, are fed to the stock, must contain more of the elements necessary for the reproduction of these crops than any other fertilizer, and must ever be the main reliance of the farmer to keep his land in good condition. But even when all the crops are fed upon the farm, there must still be a drain upon the fertility of the soil." Hence the need of mineral fertilizers to supply the drain, or of feeding more grain, &c., than the farm produces. And thus "the great question with the agriculturist should be, 'How shall I feed my crops?' The answer is a simple one: manure them thoroughly; manure them discriminatingly."

His seventh lecture is on the hay-crop. He recommends grasses that blossom in succession for grazing; those that ripen together for mowing, such as the meadow fox-tail, sweet vernal, white clover, in May; the fescues, timothy, orchard-grass, June-grass, rye-grasses, red clover, in June; red top, foul meadow, English bent, in August. By so grazing or mowing these that none run to seed, "they will remain green and luxuriant throughout the season," that is, in lands underdrained, deeply plowed, well manured, and duly top-dressed with rich compost; for these are the safeguards against drought and 'running out.'"

He pleads for the much neglected orchard-grass as the first to furnish a bite for the cattle in the spring, as little affected by the droughts of July and August, and as continuing its growth till the severe cold of November locks up the source of its nourishment."

The proper time for cutting grass, proposed as a question to farmers in two hundred towns in Massachusetts, received for answer from one hundred and fifty towns; timothy and red top when in full bloom and red clover when half the heads are in blossom, which "is the true theory." "The starch and other nutritious compounds are on the increase so long as the plant grows; but with blossoming growth ceases, and now is the time, with the least labor, to secure the greatest amount of forage in its best condition."

Lecture eighth is on potatoes, and ninth on the corn-crop; lecture tenth on root-crops; lecture eleventh on fruits, the apple in its varieties, the proper site for an orchard, and its treatment; and the twelfth is devoted to cattle husbandry, its advantages, feeding and managing stock, and the different breeds.

THE ILLUSTRATED ANNUAL REGISTER OF RURAL AFFAIRS AND CULTIVATOR ALMANAC FOR THE YEAR 1872, containing practical suggestions for the farmer and horticulturist, with about 160 engravings. By J. J. Thomas, author of The American Fruit Culturist and Farm Implements, associate editor of the Cultivator and Country Gentleman. 326 pp., 12 mo. Albany, New York: Luther Tucker & Son, 1872.

This well-known series, commencing in 1855, of which this number completes the sixth volume, contains chapters upon the following topics: destructive insects, and remedies and preventives; plowing without dead furrows, with diagrams of variously shaped plats; weed-hooks and chains in plowing; ladders and ladder stands; ornamental plant-

ing, with plans for locating dwellings on oblique roads; a plan and description of the "Boston hot-bed;" drying-house for drying raspberries; horticulture in common schools; plan of a kitchen; plowing with three horses abreast; stanchions for cattle; securing corn-fodder; fruits and fruit culture; cost of making hay; new or additional machinery; cheese-making; closing with full lists of breeders of improved stock, nurserymen, seedsmen, dealers in implements and fertilizers, and a catalogue of books on rural affairs.

FIRESIDE SCIENCE.—A series of popular scientific essays upon subjects connected with every-day life. By James R. Nichols, A. M., M. D., author of Chemistry of the Farm and the Sea, and editor of the Boston Journal of Chemistry. 283 pp., 12 mo. New York: Hurd and Houghton, 1872.

It has been the aim of the author to present some of the facts of science in their bearings upon hygiene, the arts, agriculture, &c., in a way to interest and instruct those who gather by the fireside, and those who labor in the workshop and the field.

The essay on "the origin and nature of springs," treats of the effects of water on health and disease, and the importance of proper cleanliness and purity. He attributes much of the medical efficacy of mineral waters to the great quantities drunk at unusual seasons, inasmuch as equal benefits have been effected by such use of celebrated springs, whose freedom from minerals is their sole recommendation.

The "chemistry of a hen's egg," "re-breathed air," "chemistry of a cigar," and of "a pint of kerosene," have each their interesting marvels and useful applications for the general reader. Next in order is "the lost arts" of the ancients.

The human hair, its composition, adornments, receipts for several of the most popular hair-dyes, and statements of their pernicious effects on health and life, are topics followed by an interesting bit of biography, (Michael Faraday;) after which comes the "chemistry of a lump of sugar," with descriptions of the several kinds of sugar—glucose, lævulose, and sucrose. The following is especially worthy of attention:

> Consumers of dark, coarse sugars are not generally aware of the fact that, besides the other impurities, they contain large numbers of a most disgusting insect—the *Acarus sacchari*. This insect is a very near relative of the *Acarus scabici*, which produces the uncleanly and unpopular affection called the "itch." * * * The number of *Acari* found in raw sugar is sometimes exceedingly great, and in no instance is the article entirely free from either the insects or their ova. * * * It is inconceivable that thousands of these creatures can be introduced into the human stomach without serious endangerment to health. * * * The insect is never found in refined sugars.

"Farm experiments at Lakeside" is especially worthy the attention of owners of exhausted lands or of undrainable bogs. An account of the improvement of this farm may be found in our digest of the Massachusetts report.

Mr. Nichols also warns against the numerous almost worthless compounds sold as fertilizers, and recommends either to have all fertilizing agents of home production, or to form associations among farmers, establish factories, and prepare the fertilizers for use only among those who are interested in their production.

The answer to "What shall we use for water pipes?" is, that neither lead, tin-lined lead, galvanized iron, nor brass pipes are always safe. Iron pipes are entirely unobjectionable on grounds of safety. By lining the interior with cement or glass, a conduit pipe is produced which leaves a better one hardly to be desired.

Passing "The clothing we wear," we come to "The relations of water to agriculture." The force required each year in moving water—as in plowing, hauling manure and crops, pitching hay and grain—is greater

than is expended in all the other work of the farm. The soil is full of it; manure contains 80 to 90 per cent.; in 4,000 pounds of muck there are 3,500 pounds of it, and even the farmer's driest hay holds 15 pounds per hundred. In buying a ton of superphosphate, he may buy 320 pounds of water, paying $9 to $10 for it! The honest farmer who takes one hundred gallons good milk to town has in it eighty-eight gallons of water; of course, the milk of starving cows holds more.

After several interesting essays, we come to "The food of plants," the closing essay of the volume. The beginnings and processes of growth, analogies between the digestion and nutrition of plants and animals, the elements constituting their food, the proportions of each required by different plants, and the best mode and cheapest form in which that food can be supplied to the crops, are all important matters, and are here treated in a very comprehensive manner.

SLOW HORSES MADE FAST, AND FAST HORSES MADE FASTER. A historical view of the American trotter, with approved and successful methods of developing the speed of horses, exposures of fallacious methods, secrets, and tricks of jockeys, and frauds of the turf. 12mo., pp. 102. New York: 1870.

The object of this little work is well explained in its title. After a description of the fast horses of the world, the origin of the American trotting horses and the large profits from raising them, follow directions how to produce the best trotters by proper training, with many useful hints from authoritative sources. An amusing chapter is devoted to the tricks of jockeys and the various frauds of the turf.

The love for horses is almost universal with Americans, and the rearing of them has become a large and profitable business. Vermont has long been celebrated for its trotting horses, and the Morgan breed is so identified with that State that the name is almost a synonym for horses raised there. In New York, however, the greatest attention is paid to this business. The single county of Orange has over one hundred breeding-establishments, some of which are very extensive. Charles Backman's, for instance, includes six hundred acres, where are collected upward of one hundred and fifty horses, of all ages, many of which are of the finest trotting lineage. In the rear of the immense stables of this equine village are yards, exercising-grounds, and a mile-track for training the young animals. The whole business is as completely equipped as a commercial establishment in a large city, and the owner calculates with almost equal certainty upon the profits of his enterprise. Millions of dollars are also invested on stock-farms all along the Hudson River in the breeding of trotting horses. There are similar breeding-establishments in Iowa and other Western States. For the last thirty to forty years the value of trotting horses has increased even faster than their numbers and speed, the rate being at least 100 per cent. every decade. In 1858, Flora Temple was sold for $8,000; in 1862, the California Damsel for $11,000; in 1866, Young Pocohantas for $25,000; and in 1867, Dexter, which in that year surpassed all previous speed—trotting a mile in 2 minutes 17¼ seconds—sold for $33,000. It is now no unusual thing for fast trotting horses and fine stock-horses of the best trotting-blood to sell for from ten to twenty thousand dollars. This shows the immense popularity of the American breed of trotting horses, and the amount of wealth they represent. The founder of this breed seems to have been Messenger, whose lineage is traceable back to some of the finest Arabian blood in England. He was imported into New York in 1788, and was of superb form and extraordinary power and spirit. His form, with the remarkable vitality and endurance of his race, has endowed his progeny—which has been persistently used and trained to trotting—with extra-

ordinary courage and endurance. So great has been the impress of his wonderful stamina and splendid form upon American horses that his value to the country may be estimated at millions of dollars. His stock has been bred in-and-in to an unprecedented degree, without any of the disastrous effects generally feared from inbreeding. This success has led many to think that where sire and dam are affected with no disease, inbreeding may be resorted to with safety, the only effect being to intensify in the progeny the characteristics common to both parents.

Colts, generally, are not taken in hand early enough for breaking, and become wild and unmanageable when breaking becomes necessary. Then they have to be reduced to obedience by violent and barbarous usage, by which they are often permanently injured, besides acquiring evil and mischievous habits. Breaking should begin so early and proceed so gradually that the horse will grow up in those habits of obedience and docility which give him really his highest value. The colt should be made docile and fearless by familiar handling and petting. No such thing as a whip should ever be allowed to touch the very young foals. But man, however, should always appear among his stock as master. Colts, and sometimes horses, are spoiled by being petted and played with by children and others, who, half afraid of them, do not maintain the proper attitude toward them. The feed for colts must not be heavy; during the first year they should depend upon the mare and what grass and fodder they pick up on the pasture, with one or two quarts of oats a day, after weaning and during the winter. Plenty of fresh air is an important requisite for horses, whether young or old.

After the colt is accustomed to being led about by the halter, it is time to begin his education as a trotter. He can be led on a trot around the yard, never being led too fast or too long. It should be made a game or play, and the colt should enjoy it, being always encouraged to trot and never allowed to break or run. After the first year the feed may be increased to four or five quarts of oats a day, decreasing it during the months of good pasturage and increasing it in winter. A suitable bitting apparatus may now be put on and the reins substituted for the halter. The colt should be exercised on the road and made familiar with passing vehicles and the common sights and noises. When two years and a half old, the colt may be safely broken to go under the saddle. Before attempting to use him in that way, he may be accustomed to the saddle, and by occasionally placing a child on his back, while standing beside him, there will be no trouble in using him in that way at the proper time. Too much weight in the saddle is apt to affect the symmetry of the line of the back and otherwise injure a young horse, and a rider of light weight should always be selected. After being accustomed to the road, under the saddle, the colt may be harnessed and driven with a well-broken horse. After being thus accustomed to harness, the colt may be hitched to a sulky, but, as soon as it is safe, should be changed to a skeleton-wagon. This is preferred to a sulky, as the weight of the sulky and driver presses too much on the back and loins. This is the time of the principal danger by overdriving. The young horse is going nicely to the skeleton-wagon, and every time he shows a fine gait and burst of speed, the driver is anxious to keep it up, or make him do it again. These evidences of capacity and promise should make the driver doubly cautious; and the young horse be allowed to make only short spurts of speed, and those for a short distance, and very few at any one drive. Many young horses are urged and driven until they get tired of trotting; thus whole seasons are lost, and frequently they are permanently put back.

THE STORY OF THE ROCKS: A Fourteen Weeks' Course in Popular Geology. By J. Dorman Steele, A. M., Ph. D., principal of Elmira Free Academy, and author of a "Fourteen Weeks' Course in Chemistry," &c. 12mo, 280 pp. New York: 1870.

Mr. Steele has furnished an attractive work, handsomely printed and illustrated, for the study of geology. It is divided into four parts: An introduction to the study, lithological geology, historical geology, and the age of man. Being remarkably free from technical phrases, the study is made interesting by omitting those minutiæ which are of value only to scientific men, and by presenting alone those points of general

importance with which every well-informed person wishes to become acquainted.

ON THE INFLUENCE OF THE BLUE COLOR OF THE SKY in developing animal and vegetable life, as illustrated in the experiments of General A. J. Pleasonton, between the years 1861 and 1871, at Philadelphia. Read before the Philadelphia Society for Promoting Agriculture. 24 pp., 8vo.

The author gives an account of several experiments upon plants and animals, and claims, as a result of covering a grapery with violet-colored glass, one row of panes in eight, a remarkable increase in vigor of growth and number of bunches of fruit. He also claims an increase, less marked, but plainly obvious, in the growth of young animals.

A MANUAL OF THE PRINCIPLE AND PRACTICE OF ROAD-MAKING, comprising the location, construction, and improvement of roads. By W. M. Gillespie, LL. D., C. E. Tenth edition, with large addenda. Edited by Cady Staley, A. M., C. E. 12mo, 464 pp. New York and Chicago: A. S. Barnes & Co. 1871.

It aims to teach, first, "What a road should be," in direction, slopes, shape, surface, and cost; then, its "location," with methods of performing all the necessary measurements of distance, directions, and heights; and "construction," in its details of excavation, embankment, bridges, culverts, &c. Under the head of "improvements" are examined surfaces of earth, gravel, macadamized, paved, plank, and other roads.

The following defects are charged upon the prevalent system of road management: 1st. In allowing each township to determine the quality of its portion of a road, and thus to limit its draught-capacity for all who travel its entire length. 2d. In requiring the overseers or commissioners to serve gratuitously. 3d. In electing overseers annually. As soon as they begin to understand their work, they are liable to be replaced by utterly inexperienced successors. 4th. The road-tax is fundamentally wrong. Paid in work, the tax is more unequal than if paid in money. 5th. Communities pay a full day's wages, but those who "work out their tax" give but half a day's labor, as the working is half-holiday at the best.

The better system suggested is to have each State determine by law what the roads should be; then each county, or several townships combined, should employ a competent road-maker, in order that the roads of the section or district may approximate to the standard. Abolish the personal labor tax and its commutation, and levy a money tax, so divided among the townships and the county as to apportion the burdens to the interests and benefits they severally have in the roads. If much-traveled roads extend through several counties, even a State appropriation might be required to aid in equalizing the burden. The overseer of any county or district should have an assistant in each township to see that the roads are kept in repair. As far as possible, all work should be done by contract, at a money price, and subject to such examination as will insure to the people their money's worth. The book is amply furnished with directions and rules for making calculations in road-making, and has tables embodying information on draught, grades, &c.

A TREATISE ON VENTILATION: Comprising seven lectures delivered before the Franklin Institute, Philadelphia, 1866–1868; showing the great want of improved methods of ventilation in our buildings; giving the chemical and physiological process of respiration; comparing the effects of the various methods of heating and lighting upon ventilation. Illustrated by many plans of all classes of public and private buildings, showing their present defects and proposing the best means (in the author's judgment) of improving them. By Lewis W. Leeds. "*Man's own breath is his greatest enemy.*" 8 vo. 226 pp. New York: John Wiley & Son, Astor Place, 1871.

The author was employed during the rebellion by the Sanitary Commission and Quartermaster General in improving the heating and ven-

tilation. Respecting the use of furnaces or heaters, he recommends that ventilators, to carry off the heated and vitiated air, be placed in the interior walls of a room or building, and the heaters near the external wall, so as to warm the cold air as it enters at the windows.

In Philadelphia the deaths traceable to breathing foul air amounted, in 1865, to 6,868, or 40 per cent. of the mortality for that year, while in New York it was nearly 50 per cent.

The atmosphere retains its general purity, even in large cities. Manchester (England) is the only city in Europe or America where analysis has discovered more than 10 parts of carbonic acid gas in 10,000—pure air containing nearly 5 parts in the same amount. But in our buildings deterioration begins; a lecture-room, at 42.5 at commencement of a lecture, had 67 at the close; a stable, 7 to 14; a bed-room, on rising, 48, and after two hours of ventilation, 16; and a well-filled school-room, 72 parts in 10,000.

He discusses the principles of ventilation and the various methods of heating, and indorses the utility and economy of stoves, with a proviso for proper ventilation of them. It is asserted that "All that is required is to bring in a good supply of fresh air from out of doors and discharge it *on the top of the stove.*" If the fresh air is introduced *below* the stove, "it will simply flow out over the floor, being heavier than the air in the room;" but if discharged on the top of the stove, "it falls down and mingles with the heated air arising around the stove." Let a due amount of evaporating water be mingled with the heated air, and the stove be kept from a red heat, and then, "if there is sufficient ventilation to carry out of the room directly this heated and vitiated air, and we depend mostly upon the radiation from the stove for heating, that would be *much cheaper* than the open fire, and far more wholesome than the heat from a miserable hot-air furnace."

REMARKS ON WINES AND ALCOHOL. By Charles A. Lee, M. D. Reprinted from Journal of Materia Medica for September and October, 1871. Pamphlet. 12mo. 22 pp. New Lebanon: New York, Tilden & Co., 1871.

After a brief notice of the wine-qualities of American grapes, Dr. Lee states that the reason why our native wines are not equal to most European wines is that we use grapes before they are fully matured. It is this that requires the addition of sugar, and "from a gill to a pint of either alcohol, wine-spirits, or brandy" to each gallon.

An artificial liquor, called wine, such as nine-tenths of all the *champagne* drank in the United States, containing not a single drop of grape-juice, is drank without a suspicion of its true character, and is even preferred by some to genuine wine of inferior quality. * * * Great efforts have recently been made to introduce the California wines into the Eastern markets, as substitute for others imported from Europe, but with only partial success. Some of them seem to be manipulated and adulterated almost as much as foreign wines. * * * * At some of the vineries in Los Angeles County, Indians are employed to trample out the grapes, as is the practice in some of the most celebrated wine-districts in Germany. * * * * Where wines have become too acetous, *litharge (protoxyde of lead)* or *lime* is often added; to others, sugar; but the greatest fraud consists in the manufacture of spurious wines, containing not a drop of the juice of the grape.

Dr. Lee ascribes the physiological effects of wine mainly to its alcoholic element, but modified by other constituents. Thus, *gout* results from wine-drinking, but not from pure spirit-drinking; and wine has a *tonic* influence which spirits have not. Spirits are more apt than wine to induce diseases of the liver, kidneys, and other organs.

PLATE XXVIII.

ROCKY MOUNTAIN GOAT (APLOCERUS MONTANA.)

Recently captured by Messrs. Palmer and Baker, of Deer Lodge, Montana.

AGRICULTURAL TOPOGRAPHY AND RESOURCES OF MONTANA TERRITORY.

With the exception of Alaska, the Territory of Montana is the most recently organized Territory of the United States. It embraces the region lying between the forty-fifth and forty-ninth parallels of north latitude and one hundred and fourth and one hundred and sixteenth meridians of west longitude, and it contains an area of one hundred and forty-three thousand seven hundred and seventy-six square miles, or ninty-two million sixteen thousand six hundred and forty acres, extending from east to west about five hundred and fifty miles, and from north to south about two hundred and eighty miles. The Territory is separated into two unequal areas by the dividing range of the Rocky Mountains, which forms the southwestern boundary from the west line of Wyoming to the intersection of the parallel of 45° 40′ north latitude and the one hundred and fourteenth meridian, where it bends suddenly eastward for some distance, and then runs north about 20° west to the northern line of Montana.

About one-fifth of the entire area of the Territory belongs to the Pacific slope, being drained by the headwaters of the Columbia, and four-fifths to the Atlantic slope, being drained by the Missouri. About two fifths belong to the mountain region, three-fifths spreading out eastward into broad undulating plains to the eastern boundary, which crosses the Missouri at the mouth of the Yellowstone. The mountain belt, which forms a broad margin on the western end, has probably an average width (direct measurement from the summit of the Bitter Root range to the east flank of the Rocky Mountain range) of one hundred and seventy-five miles, running northwest parallel with the western boundary.

Besides these two ranges and their interlocking spurs on the western slope, there are some minor ranges on the eastern, which, though comparatively small in extent, are important in influencing the course of the water-drainage and the form of the valleys. From each elbow of the main range long and elevated spurs run out toward each other, apparent evidences of the abortive efforts of the elevating force to keep up its direct course. Along the southern border the Snow Mountains, the northwestern extension of the Big Horn range, penetrate a short distance into the Territory, causing the Yellowstone to make a grand *détour* to sweep around the northern flank. In the central portion are Belt, Judith, and Highwood Mountains, forming an irregular group of short and broken ranges, around which the Missouri sweeps to the northward before entering upon its long eastward stretch. North of this river the plain is unbroken except by Bear's Paw, the Little Rockies, and occasional Tetons.

The chief range presents here external features differing in many respects from those which it exhibits in Southern Wyoming and Colorado. But few sharp and rugged peaks are to be seen, and instead of the rocky, jagged sides and serrated crests, there are smooth slopes and rounded outlines. Here and there the rocky substratum breaks through the surface, exhibiting sharp angles and a rugged contour, but the reverse is the rule. The general elevation, both of mountains and valleys, as will be seen from the list of elevations presented below, is much less than that of the great mountain belt of Wyoming and Colorado. The remarkable bend of the range at the southwestern angle of the

Territory, traversing three sides of a trapezium, gives to both the eastern and the western basin the form of a *cul-de-sac*, the one inclosing the headwaters of Clark's Fork of the Columbia, the other the waters of the Jefferson.

The elevation above sea-level of the following points along the line running east and west near the middle of the Territory shows that the general elevation is much less than that of the regions south:

	Feet.
Fort Union at the mouth of the Yellowstone	2,022
Trading post on Milk River	2,388
Fort Benton	2,780
Forks of Sun River	4,114
Lewis and Clark's Pass	6,519
Blackfoot Fork, near the mouth of Salmon Trout Creek	3,966
Blackfoot Fork, near junction with Hell Gate River	3,247
Hell Gate, or Missoula River, near the mouth of Saint Regis de Borgia	2,897
Summit of Cœur d'Alène Mountains, at Cœur d'Alène Pass	5,089
Fort Owen, in Bitter Root Valley	3,284
Deer Lodge, in Deer Lodge Valley	4,768
Prickly Pear Valley, near Helena	4,000

From this list, which has been taken principally from Governor Stevens's report, we see that the western or inter-montane basin reaches a depression less than 3,000 feet above the level of the sea, and that the lowest altitudes of the eastern slope range from 4,000 to 2,022 feet, while the lowest point reached by the Union Pacific Railroad between Cheyenne and the Wahsatch range is 6,140 feet. Even the lowest point of the Great Basin, near the "Humboldt Sink," is 4,017 feet above the level of the sea, 1,120 feet in excess of the elevation at the mouth of the Saint Regis de Borgia. This very important fact in regard to the physical geography of this Territory will serve as an explanation of its comparatively mild climate, notwithstanding its northern latitude.

The entire Territory may be divided into four sections, each having its water-system, and, in most cases, natural boundaries tolerably well defined as follows: first, the northwestern, including all that part of the Territory lying west of the divide; second, the southern, which is drained by the three forks of the Missouri; third, the southeastern, which is drained by the Yellowstone; fourth, the northern, including the valleys of Milk and Missouri Rivers and the bordering plains. Mr. Granville Stuart gives a fifth basin, embracing the country drained by the Boulder and lower portion of the Jefferson; but for our purpose the preceding division is perhaps the best, his fifth basin being considered as a portion of the southern section.

THE NORTHWESTERN SECTION.

This section is situated between the Rocky Mountain range on the east and the Bitter Root and Cœur d'Alène Mountains on the west, extending from the forty-sixth parallel to the British Possessions, and including all of Missoula and a portion of Deer Lodge counties. It is about one hundred and fifty miles wide and two hundred miles long, and contains an area of about thirty thousand square miles. It is traversed from southeast to northwest by Clark's Fork of the Columbia River and its leading tributaries. The northern part is variable in character, having some open prairie country, while much of it is broken and

somewhat rugged. It is drained by Flathead River, which has three leading tributaries, Maple River coming in from the northwest, Flathead from the north, and another branch from the northeast. Near the forty-eighth parallel this stream expands into a beautiful lake about thirty miles long and ten or twelve miles in width. Below this, the stream, which is of considerable size, flows in a northwest course for about fifty miles, and joins the Missoula, the two forming Clark's Fork.*

On the west side of the lake, near its southern limit, starts a range of broken, rugged hills, which extends northwest to the vicinity of Kootenay River, in the extreme northwest angle of the Territory. This range, which forms a divide between the waters of Maple River and the little streams flowing south into Clark's Fork, is covered even down to and along its base with dense pine forests. The country in the vicinity of Kootenay River is composed chiefly of high rolling prairies, through which this stream, here two to three hundred yards in width, flows with a moderate current.

Mr. Bonner, who has for some years owned a ferry across this stream, and who is well acquainted with this part of the Territory, states that the immediate valley of this river is five to fifteen miles wide, and well grassed, affording excellent pasturage. Potatoes have been grown there for several years, the tubers being large and the quality good; and although the cereals have not been tried, he thinks the climate would present no serious obstacle to their production. The Kootenay Indians, for the last five or six years, have been raising potatoes for food, but until last season have obtained their seed from the whites, possessing too little foresight to lay up a supply for this purpose until forced to do so by the refusal to supply them any longer.

For about twenty miles Tobacco Creek runs through an open prairie country, taking its rise in the forest-clad hills before mentioned. Maple River, for most of its course to its junction with the Flathead, runs through a forest-covered section. North of the lake there is an extensive prairie about thirty miles in length, north and south, and twenty miles wide, one arm of which extends northwest in the direction of Maple River and the other northeast. On the east of the lake the country is broken and mountainous, rising rapidly to the dividing range of the Rocky Mountains, which in this section presents some sharp and rugged peaks, and is generally covered with heavy timber on the western slope, while the eastern side, which is less rugged, has only a scrubby pine, which disappears toward the base.

The region immediately around the northern end of the lake is thickly wooded with excellent pine, tamarack, and fir timber, except at the extreme northern point, where the prairie before mentioned sets in. The western shore is bordered by rocky hills, covered with forests, which retire near the southern extremity, leaving some open prairie country, which is well grassed over, and it is probable that some tillable land may be found. The entire shore appears to be hemmed in by high and rugged hills, affording but little land adapted to agricultural purposes. Below the lake Flathead River is one hundred to one hundred and fifty yards in width, averages about 3 feet in depth, and descends at the rate

* The main branch of this stream has a number of different names. From the junction of Deer Lodge and Little Blackfoot Creeks to the mouth of Big Blackfoot it is called Hell Gate River; thence to the mouth of the Flathead it is Missoula; and from there it has the original name of Clark's Fork, though it is sometimes called Columbia.

of 10 feet to the mile. Along and in the vicinity of Hot Springs Creek, which enters Flathead River opposite Pend d'Oreille Mission, there is some level land and open country where good farming land can be found. The valleys of the Flathead, and the little streams which enter it from the east, afford some arable land, but this is mostly in small detached areas, in one of which Pend d'Oreille Mission is situated, where no difficulty is experienced in raising vegetables and cereals, and even some of the hardier fruits.

Jocko River runs through one of the prettiest valleys in this entire section. This valley has nearly the form of an equilateral triangle, with sides ten to twelve miles long, and contains about fifty square miles, most of which can be irrigated, the soil being rich and productive. Surrounded as it is by lofty mountains, little rills flow down into it from all sides, furnishing a never-failing supply of pure clear water. Last year the Indian agent, with but little help except that of the squaws, (the Indian men being generally too lazy to work,) raised over 1,000 bushels of potatoes, 1,500 bushels of wheat, 300 bushels of corn, &c. This corn, as he reports, yielded 75 bushels to the acre. This portion of the section has but few settlements—that of Jocko Valley being the principal one—and of the tract north of the lake little is known, though upon many of the little streams which flow down from the mountains will be found small arable areas well supplied with water for irrigation. Here, as well as in the western part of the section, many of the small valleys are covered with forests.

The southern district, which is somewhat quadrilateral, is surrounded on three sides by leading mountain ranges, the Rocky Mountains forming its southern and eastern boundary and the Bitter Root Mountains its western. It has three principal streams, which converge toward its northeastern angle. The Big Blackfoot, rising in the Rocky Mountains, runs west along its northern border; the Deer Lodge and Hell Gate, (one stream,) rising in the southeast angle, runs northwest diagonally through the district; and the Bitter Root, rising in the southwest angle, runs north near the western border.

All that portion lying south of Hell Gate River is traversed north and south by a series of somewhat parallel ridges, separated by intervening valleys of greater or less width, each drained by one leading stream. The most important of these valleys, in an agricultural point of view, are those watered by the Deer Lodge and Bitter Root rivers.

Deer Lodge valley is about forty miles long, with an average width of twelve miles that can be irrigated and cultivated. The surface is a broad, level bottom, occasionally flanked by terraces, which can be reached by irrigating ditches of moderate length, as the descent of the stream is quite rapid. The soil is good, being covered in its natural state by a heavy growth of rich and nutritious grasses, and when properly cultivated will yield abundant crops of such things as are adapted to the climate. Not only has it a central stream, which traverses the entire length of the valley, but there are quite a number of smaller rivulets flowing in from the mountains to the right and left. Below Deer Lodge City the hills close in upon the valley, leaving a narrow but exceedingly fertile bottom, which does not average more than three-fourths of a mile in width. As the elevation of this valley, averaging nearly 5,000 feet above the level of the sea, is greater than that of those lying west of it and those east of the range, its climate is less favorable to agriculture than other sections. Mr. Granville Stuart, of Deer Lodge City, gives the following as the monthly means of temperature for 1868

and 1869—the table also including the amount of rain-fall throughout 1870, and for portions of 1869 and 1871:

Months.	Thermometric means.		Rain-fall.		
	1868.	1869.	1869.	1870.	1871.
	°	°	*Inches.*	*Inches.*	*Inches.*
January	1.5	20.4	....	.64	.46
February	25.0	24.6	....	1.05	.88
March	35.4	24.0	....	1.11	1.30
April	42.5	42.6	....	1.47	1.32
May	47.0	58.1	....	3.55	2.29
June	59.2	69.7	1.00	3.85	1.07
July	61.0	66.5	.25	.28	....
August	59.0	63.1	.30	.68	....
September	50.0	51.4	.10	1.62	....
October	59.7	35.7	.00	.66	....
November	28.0	34.1	.60	1.17	....
December	26.7	24.1	.56	.42	....
Yearly mean	41.2	42.8	....	16.50	....

This gives, as the yearly mean of temperature for two years, 42; and the mean for the seasons, as follows: spring, 41.6; summer, 63.08; autumn, 43.15; winter, 20.38. The amount of snow which has fallen during the last three winters is as follows: 1867–'68, 20.2 inches; 1868–'69, 16.8 inches; 1869–'70, 27.3 inches. It must be remembered that this record, which shows a rather rigorous climate, was made where the elevation is 4,768 feet above the level of the sea, and is considerably below the average temperature of the principal agricultural areas of the Territory. Such cereals as wheat, oats, rye, and barley, and such vegetables as turnips, potatoes, and cabbages, can be raised, and will produce good crops. This valley is being settled somewhat rapidly, especially in the vicinity of Deer Lodge City, one of the principal towns of the Territory. Little Blackfoot, coming down from the dividing range, and winding its way through a mass of heavy hills, is hemmed in closely for most of its course, and affords but a narrow strip of arable land; but wherever a level space is found, the soil is rich and productive, and covered with a heavy growth of nutritious grass.

West from Deer Lodge River there is a succession of ridges and valleys running north and south. Flint Creek Valley, the first we meet with going west, is divided into two parts by a gorge four to five miles long. The upper portion is about ten miles long, with an average width of four or five miles, including that part of the bordering foot-hills which can be irrigated. The lowest part is about fifteen miles long, and, including the valleys of both forks, has an average width of about five miles. The climate here is rather milder than that of Deer Lodge and the grazing is good. It is but sparsely settled.

Westward across another ridge we enter the rough and narrow valley of Stone Creek. This stream is of considerable length, and is about the size of Deer Lodge River, (80 to 100 feet wide,) very rapid and rough, its bed being filled with stones. Very little farming land is to be found here, but the stream affords excellent water-power, and timber is abundant almost its entire length. The next and last valley toward the west is that of the Bitter Root River, which affords some of the finest agricultural lands in the Territory. From the mouth of the cañon it stretches directly north to Hell Gate River, a distance of eighty miles. From Fort Owen south it varies in width from four to fifteen miles, averaging nine to ten. North of this it is rather narrower, its

average width being not more than five miles. It is all well adapted to agriculture, the soil being a rich dark loam, mingled with sand and gravel, and, where unbroken by the hand of man, is covered with luxuriant grass, supplying most excellent pasture. In addition to the central stream it is well supplied with small creeks, which flow in mostly from the ridge to the east, among which the following may be named in descending order: Weeping Child, Skarkahoe, Gird's, Willow, Burnet Fork, Three-Mile, Six-Mile, and Bogue's Creeks, all entering from the east. Nez Percés and Lawlaw Forks are the principal western tributaries. By proper efforts this entire valley can be irrigated and brought under cultivation, affording a rich agricultural area of at least 400,000 acres. Its elevation being much less than the other valleys mentioned, it has a much milder climate. The difference in elevation, however, will scarcely account for the difference in climate, for here, especially from Fort Owen south, the valley is free of snow and the weather comparatively mild, while the valleys north, with less altitude, are covered with snow and the temperature several degrees colder. This may be accounted for, in part, in this way: The general course of the winds being from the northwest, Clark's River, from the head of Deer Lodge Creek to Lake Pend d'Oreille, forms a continuous channel, up which the wind sweeps to make its exit at the low crossing of Deer Lodge, or Silver Bow, Pass. Bitter Root Valley, being narrowed below and shielded on the west by the Bitter Root Mountains, is consequently much less liable to cold storms and heavy snowfalls. From the direction of the leading channel of this basin and the peculiar bends of the chief ranges here, reasoning *a priori*, we should be led to the conclusion that the heaviest accumulation of snow would be found on the south side, in the Big Hole, or Wisdom River basin, a conclusion which is said to be verified by the facts.

The following statistics will furnish some data by which the climate of this valley may be compared with that of other sections: Altitude of Fort Owen, 3,284 feet above the level of the sea; of Stevensville, a few miles farther up the valley, 3,412 feet; of Missoula, near the junction of the Bitter Root and Hell Gate rivers, about 3,000 feet. The mean temperatures of the seasons and of the year at Fort Owen and Stevensville are as follows:

Months.	Fort Owen.	Stevensville.
Spring	48.0	47.0
Summer	69.6	69.6
Autumn	45.6	45.5
Winter	24.9	27.6
Year	46.9	47.4

One of the best means of judging of the climate, so far as its bearing upon agriculture is concerned, is a list of its productions. Not only can wheat, oats, barley, rye, and the hardier vegetables be raised, but Indian corn of a tolerably good quality is grown here year after year. Melons, tobacco, and broom-corn thrive, and such fruits as apples, pears, plums, and cherries mature. Peach trees have been planted, and during the past season gave promise of maturing their fruit. Muskmelons, squashes,

tomatoes, beets, carrots, and onions of excellent quality and large size have also been raised.

The banks of the streams are lined with cottonwood and pine, where these trees have not been destroyed; the former 60 to 70 feet high, the latter much larger and of a superior quality, sometimes 150 feet high, 3 feet in diameter, and perfectly straight. The following sketch, by a gentleman who passed through this valley in the early part of the autumn of 1870, will convey an idea of its beauty and agricultural resources. Speaking of the farm of Mr. W. E. Bass, he says:

> The large fields of wheat, corn, and potatoes, the vegetable garden, and especially the flower-garden, excited our admiration. We saw 50 acres of wheat, averaging 40 bushels to the acre, and 20 acres of corn, averaging 50 bushels, ripe and sound. Everything else was in the same ratio. I brought away specimens of corn, onions, melons, tobacco, broom-corn, and even peanuts, which for quality and size cannot be surpassed anywhere. The flower garden was a gem of its kind, covering half an acre and containing over a hundred varieties. The barn is 165 feet long and 60 wide. The loft will hold 150 tons of hay, and the stalls below will accommodate the herd of dairy cows, fifty of which are milked, and the butter churned by water-power obtained from a small stream which irrigates the garden. [A very convenient contrivance, quite common in this Territory.] The house is prettily located among shady pine trees, a forest of which extends back to the mountain. A saw-mill furnishes the lumber used on the place. On the opposite side of the valley, ten miles away, is the farm of Mr. Thomas Harris. He has 70 acres of wheat, 50 of which are raised without irrigation, and the whole will average about 40 bushels to the acre; 20 acres a voluntary crop. Mr. Harris has an orchard of apple and plum trees of four years' growth, and the trees look very thrifty, varying from six to nine feet in height. Frost has never injured a twig. He has a field of timothy-grass from which he cut twenty tons of excellent hay, or two tons to the acre. Here were vegetables of the best quality, in the greatest profusion, watermelons, muskmelons, squashes, tomatoes, beets, carrots, and onions of large growth.

Another gentleman, who has resided in this country for several years, states that wheat, oats, barley, rye, corn, (of such varieties as are generally raised in Western New York,) potatoes of large size and superior quality, onions, turnips, peas, beans, tomatoes, melons, and cucumbers readily mature, and that the climate and soil are adapted to their production. Apples, pears, plums, and cherries were in fruit at the time this statement was made. A trial is being made with grapes and peaches, which promises success, but the trees have not yet reached a proper age for fruiting.

Although there is considerable timber between Deer Lodge and Bitter Root Valleys, the country may be considered open, furnishing a large number of extensive grazing fields; indeed, there are but few places in Montana, except in the mountains, where cattle cannot pass the winter without being fed.

The valley of Big Blackfoot is forty to fifty miles long, varying considerably in width at different points, sometimes expanding into a broad undulating prairie, through which the stream winds, flanked on one or both sides with a low bottom of moderate width, at others narrowing to what is termed a cañon, though having a valley surface of half a mile to a mile or more in width. Above the cañon is a very pretty open area, called The Belly, which is about seven miles long and four to six miles wide. The area lying between the lower part of Blackfoot Valley and Hell-Gate is an elevated rolling prairie, having the appearance of a meadowy expanse. Above the cañon the spurs and ridges are generally covered with pine forests. What portion of this valley can be irrigated is not known, but the descent of the stream being rapid, and the tributaries from the north furnishing a large supply of water, not only the immediate bottom, but also a large portion of the terraces and lower slopes, can be reached and rendered tillable.

The valley of the Hell-Gate, from the mouth of the Little Blackfoot to the lower end of the cañon, above Missoula, is sixty-five to seventy miles long. For the first twenty-five or thirty miles it is bordered by an open rolling country, sometimes broken into high hills, the immediate valley being narrow. The cañon is about thirty-five miles long, having nearly all the way a narrow strip of good bottom-land, from one-fourth of a mile to a mile wide. About thirty miles above Missoula the pine timber extends into the valley; not in a thick and massive growth, but in open groves of fine tall trees, the soil throughout being good, and yielding well under cultivation.

The Missoula Valley will average about fifteen miles wide down to Frenchtown, a distance of twenty-eight to thirty miles. From that place to the Flathead River there are open pine forests, among which some farms have already been made. This portion of the valley varies in width from three to eight miles. Although the altitude of this valley is less than that of Bitter Root, the climate is not so favorable to agriculture, being somewhat colder and liable to frosts. Thompson's Prairie, Horse Plain, and Kansas Prairie, near the junction of the Flathead and Missoula Rivers, each contain considerable good farming land, well watered, and the climate is moderate. The valley of Clark's Fork, from Thompson's Prairie to Lake Pend d'Oreille, is narrow and broken, having but few spots of arable land. It is well watered with little streams that flow down from the hills to the north, and is covered for most of the distance with a fine growth of pine and fir.

It will be seen from the foregoing description that this northwestern section of the Territory contains many arable areas, and although, with the exception of Deer Lodge and Bitter Root Valleys, they are of small size, they aggregate quite an extensive agricultural surface. The detached farms being surrounded by elevated ridges and mountain-chains, there is secured to each a never-failing supply of water for irrigation. The extensive forests will prove a source of wealth whenever the means of distribution are furnished by railroad communication with the more barren districts.

The climate is much less rigorous than would be supposed in this northern latitude and mountainous region.

Mr. Granville Stuart's estimate of farming, grazing, and timber lands in Deer Lodge County is as follows: Farming, one-eighth; grazing, five-eighths; timbered, one-fourth. This estimate will probably apply to the entire section, with slight change, the proportion of timbered land being somewhat larger, and that of grazing-land smaller.

SOUTHERN SECTION.

This section includes that portion of the Territory drained by the three forks of the Missouri, viz, Jefferson, Madison, and Gallatin Rivers; and the region as far north as Helena. It is bounded on the southwest, and partially on the north by the Rocky Mountain range; on the east by the divide which separates the waters of the Gallatin from those of the Yellowstone; and embraces Beaverhead, Madison, Jefferson, and part of Gallatin Counties. It is so irregular in form that it is difficult to estimate its area, but it is probably fifteen thousand square miles.

The physical geography of this section and the mountain regions surrounding it is very interesting, as here some of the great rivers of the West have their origin. In the mountain area in the extreme northwestern corner of Wyoming, bordering on this section, the Big Horn, Yellowstone, Madison, Green, and Snake Rivers all take their rise; the

first three finding an outlet for their waters through the Mississippi to the Gulf of Mexico; the Green through the Colorado to the Gulf of California, and the Snake through the great Columbia to the Pacific. Here, amid some of the most wonderful scenery of the continent, is found the chief radiating point of the water system of the Northwest. A minor radiating center is found in the western part of Meagher County, where the Mussel-Shell, Judith, Deep, and Shield's Rivers take their rise.

According to Mr. Stuart's division this section contains two principal basins, the one drained by Jefferson River and its tributaries, the other by the North and South Bowlder Creeks and a few small tributaries of the Missouri below the junction of the forks. The first basin embraces all of Beaverhead County and the western half of Madison, and is drained by three streams—the Big Hole or Wisdom, Beaverhead, and Stinkingwater—which unite at its northeast angle to form the Jefferson. The first of these, rising in the extreme western part of the section, following the course of the great bend of the range, sweeps round in a semicircle, and bursting through an intervening ridge, unites with the Beaverhead immediately south of Deer Lodge Pass. Its valley is crescent-shaped, and not far from eighty miles long, the widest part reaching fifteen to twenty miles. Big Hole Prairie, which forms a part of this valley, is about fifty miles long by fifteen wide. It is carpeted with a sward of nutritious grasses, affording one of the best summer grazing fields in the Territory. At some points there is a series of terraces between the smaller streams that flow into it. Although the soil in this valley is fertile, and water for irrigation abundant, the seasons are too cold to admit of its becoming an agricultural section, its average altitude being perhaps 6,000 feet above the sea, and the amount of snow-fall is greater than in any other valley in the Territory. The central part of the area inclosed by the circle of this river is occupied by Bald Mountain, from which the little streams, like radii from a center , rush down to the encircling river around the northern flank, while from the southern and eastern flank others find their way to the Beaverhead. The latter stream, rising in the southeast corner of the county, flows north to its junction with the Big Hole, the most important part of its valley, about thirty-five miles, the width of which is tolerably uniform, averaging about six miles. Between these two rivers, for perhaps twenty miles above their junction, is a level plain about fifteen miles wide, rather barren, but if watered, which probably can be done, would make good farming land. Along the bottoms the land is already taken up and settled, but these do not average more than half or three quarters of a mile in width. The principal tributaries from the west are Rattlesnake, Willard, and Horse Prairie creeks; those from the east are Red Rock and Blacktailed Deer creeks. The last three have valleys of considerable extent which afford excellent pasturage and good farming land. The climate is rather too cold, however, for anything except the hardier vegetables and cereals.

Stinkingwater River rises in the mountains at the south end of Madison County, and, running north, connects with the Jefferson a short distance below the junction of the Beaverhead and Big Hole. It has a valley thirty-five to forty miles in length, and of variable width, being separated into two parts by a short cañon immediately west of Virginia City. The upper portion, which is twelve to fifteen miles long, and one to four miles wide, is an excellent grazing section, and, except as limited by climate, is well adapted to agriculture. Some large herds of cattle and horses have already been brought into this and the Blacktailed Deer

Valley, where they pass the winter without other food than that which they clip from the open pastures. Below, the cañon is wider, and affords a large area of good farming land, a considerable portion of which is already occupied. The cereals and common vegetables are raised without difficulty, producing very good crops.

By advancing upon the broad terrace which borders this valley on the east side below the mouth of Alder Creek, the breadth of tillable land can be largely increased, and the supply of water is probably sufficient to do this. Where the streams before mentioned unite to form the Jefferson there is a broad level area, the greater part of which can be irrigated and converted into productive farms.

The valley of the Jefferson, for twenty-eight to thirty miles below this point, will average, exclusive of the table-lands which flank it, three to five miles in width. The supply of water is sufficient, not only to irrigate the bottoms or valley proper, but a large portion of the table-land, which, at some points, expands to a width of eight or ten miles, though in other places it is only a narrow strip. This is a beautiful valley, covered with grass, not only on the level portion, but far up the mountain-sides, where it meets the lower line of the mountain forests. The stream, which is probably 120 feet wide and 2 feet deep, is fringed by a growth of cottonwood and willow, the former of quite large size. Much of this pretty valley is yet unoccupied, owing, probably, to the fact that to irrigate the larger bodies of land would require the construction of long ditches to draw the water from the river. The points which are settled are supplied, as a general thing, with water from the little tributaries that flow down from the mountain, as at Silver Star.

The Madison River, rising in the region of hot springs and geysers near Yellowstone Lake, runs in a northern direction to Gallatin City, where it unites its waters with those of the Jefferson and Gallatin to form the Missouri. From the Beaverhead to the Yellowstone there appears to be a succession of short mountain ranges running north and south, with intervening valleys of greater or less width, one of which is traversed by the Stinkingwater, another by the Madison, and a third by the Gallatin.

The valley of the Madison is separated into two parts by a short cañon east of Virginia City. Above this it extends about twenty miles, varying in width from two to five miles, and is flanked by a succession of beautiful terraces, almost perfectly horizontal, which extend for miles along the valley, leading gently down from the mountains to the river on each side. The soil is, of course, gravel near the hills, but becomes finer as the immediate channel of the river is approached. On the east side of the valley several cañons give ingress to wooded streams of considerable size, which furnish the means of almost unlimited irrigation.

Meadow Creek, which joins the Madison at the upper end of the cañon, traverses a comparatively small valley containing ten or twelve sections of level land. This valley well deserves its name, for it is covered with a dense carpet of fresh, tall, green grass, and is traversed by several sparkling brooklets which, uniting, form Meadow Creek. All the terraces bordering this little valley are susceptible of irrigation and cultivation. There are now residing in this valley about fourteen families.

The part of the valley of the Madison below the cañon, reaching to its junction with the other forks at Gallatin City, is twenty-five to thirty miles long, and varies in width from one to two miles. From the cañon the river flows in a northerly course, its banks being only six or eight feet

high, yet not subject to overflow. The average width of the river is about ninety yards, the current swift, flowing over bowlders and gravel. The valley lies mostly on the east side, being somewhat narrow near the cañon, but expanding as it approaches the junction. The soil is good, the valley well adapted to farming purposes, and, the greater part having been already taken up and settled, most of the land is under cultivation. The table-lands that rise 200 to 300 feet above the valley level on the east, and form the banks of the river on the west, are unexcelled for grazing purposes, fine bunch and buffalo grasses growing abundantly. Unless the cañon should interpose an insuperable barrier, which is not probable, it will be possible not only to irrigate the valley level, but the greater part of this table-land, the amount of water being sufficient to supply a large breadth. It is probable that ere long a good road will be made along this stream and its tributary, Fire-Hole River, leading from Virginia City to the Geysers, Hot Springs, and other wonderful scenery around Yellowstone Lake.

The Gallatin River is formed by two streams called East and West Forks. The East Fork flows for some distance through a cañon which ceases about twenty miles above its junction with the West Fork. From this point it flows in a northwesterly direction, being fifty or sixty yards wide, but shallow, its banks high, and not subject to inundation. The bottom lands on the east and west sides taken together have an average width of about three miles, a large portion of which is inclosed and under cultivation. On the east side the bench or second level is about twenty feet above the bottom, and is well grassed over. This table-land extends eastward for seven or eight miles to Mill Creek or the right fork of East Gallatin, and might be irrigated at moderate expense and made as productive as the bottoms which it flanks, noted for the heavy crops they yield. Mill Creek runs northeast through Bozeman, where it connects with East Fork.

Timber is scarce in these valleys, nothing but cottonwood being found on the West Fork, and that in small groves, except near the junction with the East Fork, where there is a considerable quantity of large cottonwoods. The greater part of the timber used in this valley is hauled from the mountains south. There is a large amount of stock raised here. A flouring mill has been erected on Mill Creek, near Bozeman, and others will probably soon be built.

The East Fork, coming from the Grosfoot Hills northeast of Bozeman, follows a westerly course for six or eight miles, thence northwest to its junction with the West Fork. It is forty to fifty yards wide, flowing swiftly, its banks high and not subject to overflow. The immediate valley is two to five miles wide, while on the south a low table-land, not more than 15 or 20 feet above the bottoms, stretches out, ascending with a gentle slope to the foot of the mountains. The supply of water is ample, and the facilities for irrigation are excellent.

This is one of the finest valleys of this section. The soil is good and the climate favorable, and settlers have been attracted, so that already it is mostly inclosed and under cultivation. The stream is fringed by a fine growth of cottonwood and aspen, the only timber in the valley, the deficiency being supplied from the mountains to the north. As a general thing, the southern part of this section is not so well timbered as the regions to the northwest, but the mountains will furnish a supply for ordinary purposes, though these in many places present quite naked slopes, smooth, and grassed over, often to their summits.

Passing north from the central part of the Jefferson we enter what

Mr. Stuart calls the "Eastern Central Basin," and which he describes as follows:

This basin is drained by the Missouri River below the Three Forks, and above them by [the lower tributaries of] the Jefferson, the North Bowlder, South Bowlder, and Willow creek. It is also traversed by the lower portion of the Madison and Gallatin rivers, which form a junction with the Jefferson in a fertile plain of considerable extent. It contains a large amount of arable land, with a climate comparable with that of Utah, and is about one hundred and fifty miles long north and south, by eighty east and west. Its five principal valleys are the valley of the Three Forks, of the North Bowlder, of the lower part of the Jefferson, of the Madison, and of the Gallatin; furnishing a larger amount of farming land than the basin of the Beaverhead and its tributaries.

The valley of the Missouri along this part of its course is narrow, but quite fertile, possessing a very favorable climate. It is watered on the east side by numerous little streams which flow down from the Belt Mountains. The interior of the basin is traversed by several sharp and elevated ridges, the principal one stretching from near the lower part of the Jefferson a little west of north, and connecting with the Rocky Mountain range near the source of the Prickly Pear Creek. The North Bowlder runs along the western base of this ridge through a valley of moderate width, while west of it runs another ridge separating its waters from those of Whitetail Deer Creek. These ridges are clothed with pine timber of an excellent quality. Branching off from the first ridge, near the center of Jefferson County, starts another ridge which, running north, forms a divide between the Prickly Pear and the Missouri.

Prickly Pear Creek, and Ten-Mile Creek, its principal tributary, have very pretty valleys, which are contracted at some points by the approaching ridges, and at others expand into broad, open prairies, having the beauty of the smoothest meadow. One of these beautiful meadow-like openings is in the vicinity of Helena, across which we may look from the city and see the noted landmark repeatedly mentioned from the days of Lewis and Clarke to the present time—the Bear's Teeth. This valley here is from five to fifteen miles wide, and twenty to twenty-five miles in length. Although rich and productive, the streams which traverse it afford water to irrigate only a part of it. A proposition has been made to bring water from Jefferson River, a project which is said to be practicable.

The proximity to the chief city of the Territory would certainly render the land valuable, and such a canal would be useful, not only for irrigation, but also in connection with mining operations. Major J. F. Forbis, who has been farming in this valley since 1865, and has made the raising of vegetables for the city something of a specialty, furnishes the following information in regard to its productions:

Wheat, after the first few crops (which are generally very heavy) have been cut, produces 20 to 40 bushels per acre; 82 bushels have been taken from an acre, and entire crops have averaged 56 bushels on fresh soil. One difficulty experienced is that volunteer crops mix with those that follow. This does no damage when feed-crops, as oats and barley are raised, but when wheat follows other crops, the mixture injures its value. Weight, about 60 pounds to the bushel. The average yield of oats is about 40 bushels to the acre. Barley produces about 30 bushels on an average, but often the yield is as heavy as that of oats. Potatoes, turnips, rutabagas, beets, cabbages, carrots, onions, parsnips, peas, beans, and radishes do well, no climatic difficulty attending their cultivation. Tomatoes can be grown with care, but are liable to injury from frost before maturing. Spring wheat is generally sown in March, and sometimes as early as the last of February, but even as late as May will

answer. Harvest usually begins in July. Fall wheat is usually sown in September and October, but it generally comes out too soon in the spring, and is liable to be bitten off after jointing. Currants, gooseberries, and strawberries do very well; the native varieties of gooseberries and currants bear transplanting without injury, and improve under cultivation. Native raspberries and strawberries have not been tried. Other fruits, as far as tested in this valley, have proved a failure, but some varieties of the apple might succeed.

Mr. Forbis planted some hemp seed in a garden in Helena, 400 to 500 feet above the valley level, and he states that some of the stalks grew 10 to 12 feet high, and as large round as a man's wrist. He is now testing it on his farm, and it is growing finely. He has raised hemp in Missouri, and is satisfied that it can be produced here as easily, and of as good quality, as in that State.

The climate is variable, the weather often being mild and open at Christmas, after killing frosts. Snow does not generally set in until December, and continues at intervals up to the 1st of March, though the quantity that falls is quite small, seldom covering the valley more than 2 or 3 inches. To afford additional means for the comparison of this with other valleys, it may be stated that the barometrical measurements taken in Major Forbis's door-yard show the elevation to be just 4,000 feet above the level of the sea.

On the east side of the Missouri, in the bend which this river makes here, from a north to a northeast course, are one or two valleys, which may be considered in this connection, though not strictly belonging to the southern section. North Deep Creek, which rises in Belt Mountains, and flows north to the Missouri, has a valley 40 to 50 miles in length, which averages about 3 in width. At one place, for a distance of 15 to 20 miles it widens to an average of 5 miles, but at other points the spurs and hills close in upon it, rendering it but a narrow strip.

South Deep Creek gives a valley of twenty-five to thirty miles in length and four or five in width, being at no point within this distance less than two miles wide. Water sufficient to irrigate these valleys can be obtained either from these creeks or their tributaries, and near the mouth of the latter any deficiency can be supplied from the Missouri. The soil is good, and settlements have already been made here, this being considered one of the best agricultural points in central Montana.

NORTHERN SECTION.

This section embraces all that part of the Territory lying east of the Rocky Mountains and north of the divide which separates the waters of the Yellowstone from those of the Missouri. It is an extensive region, stretching from east to west three hundred and fifty to four hundred miles, and varying in width, north and south, from one hundred to one hundred and seventy-five miles, including the north part of Deer Lodge, all of Chouteau and most of Meagher and Dawson Counties. With the exception of the portions occupied by Belt, Highwood, and Judith Mountains south of Missouri River, and by Bear's Paw and Little Rocky Mountains north, it is generally an open, undulating, treeless plain, gradually descending eastward, with an average slope of five feet to the mile. But this descent differs very materially in the portions east and west of Fort Benton, the descent of that west to the base of the mountains having an average of thirteen to fifteen feet to the mile, while that east has an average of less than three feet, if the barometric observations taken along this line are to be relied upon. With this slight

descent east of Fort Benton there is little prospect of redeeming any great portion of these plains; for, if the rate stated is correct, it will be impossible to reach the higher table lands with canals from the Missouri.

Along the east base of the Rocky Mountains from the British Possessions south to the Sun River there is a strip, about thirty miles in width, of arable land, which is well watered by the numerous little tributaries of the Marias, Teton, and Sun rivers, which flow down upon the plains. The descent being rapid and these streams but a few miles apart, flowing in somewhat parallel lines, a large portion of this strip, which is about one hundred miles in length, can be irrigated and brought under cultivation. As yet it is wholly unoccupied except by roving Indian bands; hence no experiments in farming have been made. Mr. Hard, who has been traveling over this portion of the Territory summer and winter for some years, states that the seasons are not severe, and he is satisfied from his knowledge of the climate that the hardier cereals and vegetables can be raised without any climatic difficulty. The grass is good here, and the great buffalo herds of Eastern Montana, apparently fleeing before the Sioux, have, during the present year, been moving into this region.

The Marias River, after it enters upon the plains, runs through a deep channel, bordered in part by broad table lands, and partly by long sloping hills, a portion of which, by the constrution of long canals, might be irrigated and made suitable for agricultural purposes.

Teton River is probably over one hundred miles long, its two branches, rising by different heads in the Rocky Mountains west of the Teton, flow round this *butte* and unite at its east base. It has some good bottom lands in its valley, which varies from two to six miles in width for a part of its length, but at other points is quite narrow. The bordering plains are generally undulating, but a portion is composed of level table-lands which are fifty to seventy-five feet above the valley level. The stream is rather small, its average width probably not exceeding twenty-five to thirty yards, but it is a constant runner; its lower portion runs slowly, the descent being slight.

Sun River, rising in the Rocky Mountains, immediately west of Fort Shaw, runs east about seventy miles, and, passing by this fort, empties into the Missouri. It forms the north boundary line of Lewis and Clark Counties. The immediate and cultivable valley varies in width from one to three miles, the soil being of the best quality. At some points the bottoms are flanked by terraces of moderate height, which may be reached by irrigating ditches, thus increasing the breadth of farming lands in this beautiful valley, considered one of the finest in this part of the Territory. The stream is about sixty yards wide, flowing rather swiftly over a gravel bed, and seldom, if ever, overflowing its banks. There are as yet but few settlements in the valley, Fort Shaw, situated about six miles east of the "Helena Guide Mountains," being the most elevated. Lower down, about four miles distant, is the Sun River Crossing, on the main road from Helena to Fort Benton, around which there are several farms under cultivation. From this point to its junction with the Missouri, about twenty-five miles, the valley increases in width from three to five miles. There are some cottonwood and aspen along the river, but other timber is scarce. The higher table lands on the north and south offer excellent grazing fields, the soil being generally very fertile, that of the plateau on the north needing irrigation only to make it as productive as the bottoms of the valley.

The valley of the Missouri, from the Three Forks to the mouth of Sun River, is very rich and fertile, but is rather narrow, varying from three

to eight miles in width, and at some points the hills close in upon it, leaving but a narrow strip of bottom land along the stream. The length of the valley between these points is about one hundred and fifty miles. It is tolerably well settled, the climate being mild and the productions as varied as in any portion of the Territory. Wheat, oats, rye, barley, corn, and the usual vegetables, grow well and produce heavy crops, Helena receiving a large part of its supply of vegetables from here. Such fruits as apples, plums, cherries, currants, raspberries, and gooseberries may be grown here. As a general thing, after leaving the rapid descent along the base of the mountain and entering upon the broad, open plain, the rivers of this section run in deep channels, which, like great ditches, traverse the plains and are often, for long stretches, sunk 100 to 150 feet below the surface.

On the south side of the Missouri the most important basins within this section are those of the Judith and Mussel Shell rivers. The Judith basin is wide, spreading out forty to fifty miles, and extending north and south about eighty miles. It is traversed by the Judith River, which has three tributaries, West Fork, South Fork, and Big Spring Creek. West Fork is a short creek affording a moderate valley, but in regard to this little is known. The valley of the South Fork is very irregular, frequently closing up; it is about twenty-five miles long, the ten miles next the mouth averaging two miles wide, the remainder variable, but generally quite narrow. The lands which border this stream are more rolling and irregular than is usual in the basin, but are covered with good grass. Big Spring Creek has one leading tributary, Cottonwood Creek, which has a valley twelve miles long and from a half mile to a mile wide. The supply of water in each of these valleys is sufficient to irrigate all the land sufficiently level for culture. The area between these valleys consists of a level plateau about 100 feet above the level of the streams, and during the summer season it has a bright-yellow hue, from the vast number of *Helianthi* growing upon it. The Judith Valley proper is about eight miles long, and varies in width from one to four miles. The bordering region, as we approach the Missouri, grows barren, and assumes that appearance to which the name "Mauvaises Terres," or "Bad Lands," has been applied, but the surface is mostly covered with bunch grass. Stunted pines and cedars grow along the Missouri from Fort Benton to the mouth of Mussel Shell River, for 20 to 25 miles back.

From the mouth of the cañon on Mussel Shell below Fort Howie, for twenty-five miles down, is a very fine farming country; the valley averages five miles in width, the soil is good, and the climate favorable. Near the mouth of this stream the valley is narrow, the bottoms averaging not more than a mile and a half wide, nor is the soil so good as along the upper portion. No information in regard to the intermediate part of this valley has been obtained, but the bordering plains are supposed to consist, in a great measure, of bad lands, similar to those near the mouth of Judith River.

SOUTHEASTERN SECTION.

This section includes the area within the territory drained by the Yellowstone and its tributaries. Little is known in regard to its agricultural resources. The following account of a voyage down the stream in a boat, by Judge Horner, contains, perhaps, all that has been ascertained in regard to it up to this time:

The description of the lower valley of the Yellowstone given by Captain Lewis, without being full, is very accurate in geographical information. I was enabled by it

to anticipate our approach to the various landmarks, rapids, and the mouths of the various tributaries. In minor details it is deficient. No continuous account of this valley from the cañon, twenty-five miles beyond Bozeman, to the mouth, a distance of eight hundred and twenty miles, has ever been published. For the first eighty miles (from the mouth of the cañon) the river is almost one continuous rapid. Numerous ledgy islands are scattered along, furnishing coverts for large flocks of ducks. The banks are generally abrupt, in many places precipitous, thickly covered with soil, and sparsely covered with stunted pines. Occasional accumulations of *débris* spread out into small bottoms covered with immense cottonwoods. The banks on each side rise gradually into lofty hills, but the vegetation is light. Long high ranges of mountains approach the river on each side. The water here is pure and very transparent. The bends of the stream are somewhat angular, formed of long and straight reaches, so that the eye can often follow them for six or eight miles. Dense thickets of willow grow along the margins and on the islands.

The second day we came in sight of the vast ridge of yellow sandstone from which the river derives its name. This ridge appears to be about 300 feet high, and this part twenty miles long. The bluff it forms is precipitous. The top is covered with pines. The valley of the river here is greatly expanded, spreading out into alluvial bottoms six to eight miles wide, gradually growing into upland and foot-hills. The soil here is equal to that of the Gallatin. The descent of the river is much less rapid than above, miles intervening without any perceptible inclination. The termination of this portion of the ridge is at an angle of the river where it has worn a passage through, the rock on each hand exhibiting a sheer bold precipice of stratified sandstone, very hard, and of a deep ocher color. The river is quite shallow where it crosses this ledge, which stretches off on the west side in a straight line across the valley twenty or thirty miles. The bottoms here are extensive, (between the ridge and river,) and are susceptible of high cultivation. There are frequent long groves of cottonwood here. We passed through this marvelous ridge five or six times in traveling three hundred miles. In some places it follows the river for miles, casting its somber shadow on the water. In others it is curiously eroded into resemblances of towers, castles, citadels, &c.

At the terminus of the ridge, the river, increased to twice the size at the commencement, by the contributions of Rose-Bud, Clark's Fork, and Big Horn, is fully one mile wide and very deep. Its waters are turbid, its banks low, and it rolls down an immense volume of water, undisturbed by a ripple, through large spreading meadows beautified by occasional trees and carpeted with thick grass. With the exception of a few rapids, some of which are formidable, this is the general character of the scenery until we approach the mouth of Powder River. Here a sudden change takes place, and all at once we are ushered from the highest state of verdure to that of extreme, absolute desolation. Here commences the *Mauvaises Terres*, and from this point to its mouth the same general features characterize the scenery as those found along the Upper Missouri, intensified, if possible, by frequent views of long burnt plains, seamed with immense ravines and dotted with enormous tables of baked clay. It is, without exception, the most horrible looking country I ever saw. The hills and mounds of stratified clay along the bank of the river frequently rise 1,500 feet, void of vegetation. The river is here a dark drab color, with shifting channels and numerous sand-bars. Its clay banks for hundreds of miles exhibit on each side continuous veins of decomposed lignite. A railroad could easily be built along its course, except the 180 miles from the mouth of Powder River down. Above Powder River the obstructions are few and easily overcome. Three hundred or four hundred miles would be through the largest and richest valley in Montana, yet unsettled, and not more than 1,500 to 2,000 feet above the level of the sea.

The amount of land in the Territory which can be irrigated and profitably cultivated is estimated at one-twelfth of the whole area, twelve thousand square miles—7,680,000 acres.

STOCK-RAISING, CLIMATE, ETC.

Without injustice to any other part of the West, it may be said of Montana that it is probably the best grazing portion of the Rocky Mountain region. Not only are the open plains and prairies covered with excellent grass, but the smooth hills and naked mountain slopes, and even the reaches beyond, far up into the timber, have the same covering. Wherever a fire has swept a mountain side, destroying the pine trees, leaving the blackened stems and stumps to mark the place where the forest has been, there springs up a tall, green, and exceedingly nutritious grass, covering every spot traversed by the fire. Here, as in the other parts of this western country, the grass, instead of rotting, cures on the

ground, remaining in this state all winter, furnishing a better food than if cut and cured. There is seldom any difficulty experienced on account of the cold or snows of winter, many who have stock running on the prairies making no preparation for winter feeding, which is seldom necessary. Even in the upper part of Stinkingwater Valley, where the climate is considered somewhat rigorous, not only are the regular herds wintered on the prairies, but cows also pass the winter with no other food than that cropped from the open pasture, and although regularly milked come out in the spring in excellent condition. A gentleman who visited this section in the early part of summer, informed us that he saw cows, which had thus passed the winter on the range, giving milk the entire season, and in such fine condition that they would have made excellent beef, some giving three gallons of milk each morning and evening. Notwithstanding this fact, cows command a high price, the best bringing readily $80 to $100, on account of the demand for stock-cattle. Stock is being rapidly introduced into the Territory, which will soon bring down the price.

We have but few statistics in regard to the herds. The herd of Messrs. Poindexter and Orr, on Blacktail Deer Creek, at the commencement of the present season, was said to embrace 2,467 sheep, 1,500 cattle, 750 calves, 450 horses, and 75 mules.

The following particulars have been received in regard to the progress of agricultural experiments at the Indian agencies in the Territory up to the present time: At the Crow agency, on the Yellowstone, a main irrigating canal, more than two miles long, and numerous lateral ditches, have been constructed. Nearly three miles of fencing have been built, inclosing about 500 acres, of which 112 acres are under cultivation; the remainder is to be broken up this fall, preparatory to cultivation next season. The crops usually raised are wheat, oats, barley, potatoes, turnips, &c.

At the Blackfoot agency, north of Sun River, there are about 85 acres under cultivation, and 150 inclosed. The crops, of the same description as at the Crow agency, grew finely the past season. Corn, of the Canada variety, called here the Rhea corn, has been planted, and appears to be doing well. There seems to be no doubt of its maturing, as it has been raised at other points in this section. Irrigating ditches, sufficient to supply the 150 acres, have been made, and are ready for use.

At Fort Lunhi, on Salmon River, 50 acres have been brought under cultivation for the benefit of the Bannack, Shoshone, and Sheepeater Indians. The crops raised are chiefly potatoes and turnips; some wheat and barley have been sown. These crops, at last accounts, looked well and gave promise of complete success. The most encouraging feature of this place is that the Indians are doing the greater part of the work. These Indians have been so long associated with the whites that they know the beneficial results of labor, and are very much pleased to have a chance to cultivate the soil for their own benefit.

Twenty to twenty-five adobe houses have been erected at the Crow agency for the Indians, into which they are to go this winter, and the agent intends, if possible, to have thirty-five to forty more ready by the time winter sets in. Each house has connected with it a small plat of ground or little farm.

The Flathead agency, in Bitter Root Valley, has about 40 acres under cultivation. These Indians are chiefly connected with the Catholic mission at this point.

The following statistics, from the auditor and treasurer's report for

1870, show the progress of agriculture and industrial pursuits in this Territory, exclusive of the mining interests:

Counties.	Land in cultivation.		Valuation of—			Wagons and carriages.	
	Acres.	Value.	Town lots.	Ditches.	Flumes.	Number.	Value.
Madison	35, 442	$67, 300	$116, 428	....	$33, 745	508	$33, 468
Lewis and Clark	28, 225	174, 685	841, 625	....	....	716	60, 297
Deer Lodge	24, 020	65, 450	177, 346	....	....	242	18, 175
Beaverhead	9, 980	40, 125	34, 318	....	....	....	8, 280
Jefferson	24, 098	47, 795	10, 608	$26, 000	....	278	12, 747
Gallatin	46, 716	100, 118	50, 760	....	....	402	24, 865
Meagher	11, 320	36, 335	11, 808	....	....	164	10, 114
Missoula	21, 151	114, 165	78, 976	....	....	218	14, 528
Chouteau	1, 135	4, 685	50, 840	....	....	230	18, 105
Total	202, 087	650, 658	1, 372, 709	26, 000	33, 745	2, 758	200, 579

Counties.	Horses.		Mules.		Oxen.		Cows and other cattle.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
Madison	1, 455	$87, 825	302	$23, 962	812	$44, 565	7, 056	$224, 697
Lewis and Clark	1, 106	63, 142	395	39, 050	2, 296	98, 887	3, 689	108, 172
Deer Lodge	1, 477	79, 647	181	13, 810	....	....	6, 450	230, 345
Beaverhead	584	31, 910	41	2, 272	225	12, 175	4, 851	134, 766
Jefferson	859	39, 408	170	15, 560	1, 363	66, 497	6, 377	177, 576
Gallatin	759	46, 420	187	23, 495	1, 208	62, 040	7, 062	205, 732
Meagher	391	26, 405	82	11, 960	369	23, 206	3, 379	116, 687
Missoula	1, 793	85, 288	262	14, 690	394	18, 275	3, 843	128, 690
Chouteau	196	9, 500	27	2, 540	1, 175	55, 097	236	6, 945
Total	8, 620	469, 545	1, 647	147, 339	7, 832	380, 742	42, 943	1, 333, 610

Counties.	Hogs.		Sheep.		Capital in manufactories.	Capital employed in merchandise.	Total assessed value.
	Number.	Value.	Number.	Value.			
Madison	350	$2, 629	21	$205	$167, 750	$299, 130	$1, 522, 599
Lewis and Clark	576	4, 768	19	87	30, 858	815, 165	2, 799, 769
Deer Lodge	288	3, 220	22	110	6, 260	227, 928	1, 399, 879
Beaverhead	109	722	1, 100	3, 575	15, 962	30, 561	406, 099
Jefferson	138	461	2, 757	8, 492	425	23, 125	492, 597
Gallatin	322	2, 834	....	....	....	....	707, 283
Meagher	367	2, 006	....	....	....	64, 580	413, 194
Missoula	847	3, 956	293	3, 410	17, 387	99, 794	690, 865
Chouteau	11	115	....	....	4, 000	75, 850	280, 450
Total	3, 608	21, 211	4, 212	15, 879	242, 642	1, 636, 133	8, 712, 735

THE RELATIONS OF AGRICULTURE TO OTHER INDUSTRIES.

Mr. Caird, the highest British authority, in his work entitled "English Agriculture in 1850–'51," after carefully exploring thirty English counties, reports that in twelve northern counties, which include the coal region and the seat of mining and manufacturing enterprise, agricultural wages average 11*s.* 6*d.* ($2.79) a week, while in eighteen southern counties, whose productive industries are greatly less diversified, agricultural wages are not above 8*s.* 5*d.*, ($2.04.) "The influence of manufacturing enterprises is thus seen," he observes, "to add 37 per cent. to the wages of the agricultural laborers of the northern counties as compared with those of the south;" and what is specially noteworthy in his statement is that "the line is distinctly drawn at the point where the coal ceases to be found." Arthur Young very carefully and very thoroughly investigated the question in these same counties in 1770. Comparing the rates ascertained in 1850–'51 with those given by Young, eighty years previous, Mr. Caird found that the wages of agricultural labor had increased in this period 66 per cent. in the northern counties, while in the southern counties the increase was but 14 per cent. In Lancashire and the West Riding of Yorkshire, which are the seats of the most extensive cotton and woolen manufactures, the increase was quite 100 per cent., standing at 15*s.* ($3.64) per week, while in South Wiltshire the weekly wages were down to 6*s.*, ($1.45.)

To produce and maintain a disparity so great as in these extreme instances, in the price of the same kind and amount of work, and in places so little remote from each other, (they are about two hundred miles apart,) several causes were at work, but far the most effective was, unquestionably, the presence of great manufacturing establishments in the northern, and their absence in the southern districts.

The contrast tried by the increase of population stands thus: In 1861 Lancashire had a population of 1,275 to the square mile; in 1871 the increase in numbers was 389,444, equal to 16 per cent. In 1861 Wiltshire had a population of 184 to the square mile; in 1871 the increase in numbers was 7,891, or $3\frac{1}{5}$ per cent. The average increase of the United Kingdom in these ten years was 8.30 per cent.

The wages of labor must be paid out of the value of the product. Skilled industry takes two or three times the reward of unskilled, because it contributes that much more to the production of the result, and therefore a difference in the wages of labor, in similar conditions, is proportionate to the difference of its productive value. If it be objected that a higher style of labor draws off the supply of the lower, and raises the wages of the lower by lessening its supply, the terms of the proportion are only shifted, the effect remaining unaltered. The aggregate is thus enhanced to the same effect as if all the elements were evenly advanced.

All that we wish to make of this point is that the wages of labor are the index of value in productive industry. Adam Smith's maxim, that "Labor is the ultimate price which is paid for everything," does not carry instant conviction of its truth. Mr. Carey's happy definition of *value*—"the measure of nature's resistance to human power"—is, in effect, the equivalent of Smith's statement, with a clearer presentment of the argument involved, and needs only the more detailed explication that natural and artificial labor—manual, mechanical, and chemical labor—is the price paid for all things. J. B. Say insists that "values produced are referable to the agency and concurrence of industry, of capital, and of natural agents;" but he elsewhere admits that "capital is nothing

more and nothing less than labor accumulated," or, as Smith styles it, "dried labor." So these two of his agents are but one; and, if the occasion allowed or demanded the demonstration, it would not be hard to show that what he styles "natural agents" are, in fact, natural *subjects* of industry, in its largest meaning; for neither soil, nor air, nor lightning, nor any chemical force, serve in the production of values for man's use until he has subdued and compelled them into his service. There is more meaning in the terms in which the commission of human sovereignty over all creatures is given than appears at first sight: "Replenish the earth and *subdue* it; and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth." The condition annexed is, "In the sweat of thy face shalt thou eat bread, until thou return unto the ground." The condition of dominion is that he must catch the fish, the fowl, and the living things that move upon the earth before he can cook, clip, or work them. The forest fruits he must gather in their season before he eats them, and he must preserve them if he needs them out of season; yet all this toil will not advance him beyond the savage state. If he would make the wild animals serve him in a higher style of life, he must domesticate them and provide their food. If he would emancipate himself from bondage to the elements, or subject them to his service, he must catch the wild winds and the rushing waters, and hold them to their duty. The soil beneath his feet, with all its "natural agencies," is in open and stubborn rebellion to his rule. Nothing in nature volunteers for his service. Bone and muscle, brain and nerve, must give them all their utility; and all their value is just the price of their conversion into the required forms of service. Labor accumulated takes the modified form of capital; but it must be observed that in this shape it retains all the functions of its pristine form, and in production is nothing but artificial labor, and is best carried in our thoughts under that name. Labor is the creator of capital, and remains its governor and guide. A money-owner is not a manufacturer. The artisan and the superintendent must come in between and produce the effect. The brain and hand make the machine, and through it give form to the product, under the constant direction of that industry which holds it to its work. All this, in the last analysis, is labor; and it is this division of labor—not the division that parcels the making of a pin among a dozen hands—"that occasions in a well-regulated society that opulence which extends itself to the lowest ranks of the people." All that is best in all the contributors to the work and service of the world, in the integral individuality of each, limits the division of labor, if human nature is not to be sacrificed to the production of commodities; or, as it has been happily said, if products are made for man, and not man for products.

But all our present use for this principle is to fix the point that wages are the measure and index of productiveness, that we may derive from the instances the evidence that higher wages mark and prove proportionately higher styles and services of industry. The chiefest among the grand foundation-facts in political economy is, that only in advancing conditions of society can land and labor increase in value, and that all economic welfare depends upon their associated advancement; or, what is the same thing, upon their improvement, which alike and equally in either case depends upon labor. In the one case, through education, training, exercise; in the other, through enrichment by that education, training, and exercise applied to it.

But what is all this to the development of our theorem: Agriculture

dependent upon, and its development measured by, the diversification of all other related industries? This proposition, as a general and abstract statement, really needs no argument; but some illustration will serve to unfold the law for the practical uses which it should serve, where guidance is needed through apparent difficulties in its application. In savage states of society, land is without any exchange value. It is not any more an individual property than a railroad car is to a passenger. A temporary, a vagrant occupancy is its only use; and the title lasts no longer. It belongs to everybody, and, therefore, to nobody. Why? Because nobody demands anything of it or from it, for any use beyond such service as it renders to the fowls and wild beasts that roam over it. Wild men are not any more its inhabitants or owners than the irrational créatures are. In this condition of things, there is only one kind of property—chattels, or personal property—and from this fact we derive a rule for measuring societary systems of every grade, from the lowest savagism up to the highest civilization. It may be thus stated: The proportion of fixed capital, or real estate, to floating capital, or personal property, held by any people, is the measure of its wealth and of its grade of civilization. Among savages, as we have said, real property scarcely exists. In the highest civilization and greatest prosperity, real property preponderates, and its degree of excess over personal indicates and measures the national welfare. For example: The real estate of the late Confederate States, as reported in the census of 1860, held an average of 43 per cent., and the personal 57 per cent. of their property; while in the loyal States, the real was 66 per cent. and the personal but 34. At the same time, the average ratio of real to personal estate in New York, Massachusetts, and Pennsylvania was 75 per cent. of the total, or, as 75 against 33¼ in Maryland, Mississippi, and Texas. This difference expresses not only the material wealth but the warlike strength of the two sections. If the confederacy had not been conquered in the Federal treasury, it could not have been done in the field by the Federal armies. Moreover, in the issue, the region of the preponderating real estate wealth came out of the conflict richer than it went into it, while that of the preponderating personal wealth was beggared and ruined. There is a good reason for calling land and its imperishable improvements *real*, in contrast with that which "perishes in the using."

But land in its primitive condition has no value whatever. Its original and inherent capabilities for the service of man are nothing as it lies in desert. A continent in this condition has no more worth than the bottom of the sea, and in any grade of cultivation its original powers never enter into its exchange or market value.

The census of 1870 values the improved lands of Nevada at an average of $16.03 per acre and the annual product at $17.91. These lands were then carried but little in advance of the state of nature. In South Carolina, where they were nearly returned to their primitive condition by a murderous system of tillage, the average value per acre was put at $14.88 and the annual product at $13.91. Here the crop of a single year is equal to 93½ per cent. of the cash value of the improved lands; while, in contrast, the average value of the annual products of New Jersey was but 16½ per cent. of the cash value of the lands; in Illinois, the rate was 23 per cent.; in Ohio, 18.8 per cent.; in Pennsylvania, 17.6 per cent.; in Massachusetts, Connecticut, and Delaware, 18.53, 16.08, and 17.04 per cent., respectively.

As a further indication of the disparity between real and personal estate, in the really wealthy and in the poor communities, it is worth

noticing that the value of the live stock in South Carolina was equal to 28 per cent. of the value of the farms, while in Ohio it was no more than 11½ per cent.

That the instances here presented are not selected for the purpose of proving the point intended to be made, will be seen by any one who will take the trouble of looking over the entire tables of the Agricultural Report of 1870. The facts and figures result from a truth that underlies and controls them; it is this: land derives *all* its value from the labor bestowed upon its improvement, and that value is measured accurately by the quality and amount of the industries which are employed and reflected upon it. To present this point with adequate force we take the census valuation of the real estate of the State of New York in 1860, which is put at one thousand and seventy millions. To avoid any possible undervaluation, we will assume it at fifteen hundred millions. Now allow one million of men one dollar a day for their labor, and for three hundred days in the year; they would earn the total sum in five years. Can any one imagine that anything less than five or ten times this amount and value of labor has been employed in the two and a half centuries that have elapsed since the work of building up the State began? The lands of the State, including the cities, towns, and villages, are worth, now, say $80 per acre. As good lands in the West are sold at $1.25, and it is not probable that New York would have commanded so much when it was first settled by the Dutch in 1614. It is plain, therefore, that labor has given the State all the difference of the value then and now, and just as plain that the whole State is not worth the fifth, or perhaps the tenth, of that labor which has made it what it is. A share or part only of the present value is due to the labor expended directly on the land. It has been cleared, ditched, fenced; it has been plowed, harrowed, and manured, and it has been furnished with houses, barns, and other necessary buildings. Roads have been constructed, bridges built, canals and railways have been made, and school-houses and churches have been erected. Outside of all this, roads, ships, and telegraphs have effected communication with the whole continent and the world beyond; and every item of all the labor employed upon all these has been concerned in adding value to the lands and other real estate of the Empire Commonwealth. All this world of work going on in it, and around it, for two and a half centuries, by many millions of men and women, assuredly has cost the present cash value of the entire territory many times over. Nor can there be a single lot on Broadway, in the Empire city, that would pay more than a fraction of the cost that has given it its present market price. The same may be said of every other foot square in the wealthiest nation in christendom.

The doctrine of "the original and indestructible powers of the soil," and the notion that the use of these enters into rent and sale as a part of the price, like other fallacies of theoretical economists, lies directly across the path of our argument and opposes its practical results; for, if the whole value of land arises from the labor directly expended and reflected from outside industries upon it, the interest of the land-owner or farmer makes the care of all such related industries a necessary part of his policy. This conscious dependency incites him to look to it that such a diversification and efficiency of all other productive occupations as his own depends upon for its prosperity shall be fostered, encouraged, and extended. He will look at the fact that the farm lands in the neighborhood of a great manufacturing city have their value many times multiplied by the demand made upon them for the necessary con-

sumption of such of their products as will not bear distant transportation. He will remark the fact that it is solely owing to such contiguity that lands in the four counties surrounding Philadelphia average, respectively, $160, $127, $125, and $215 per acre; while those equally good, but much farther from a home market, will not command half these prices; and carrying his inquiries further than the most striking instances, he will perceive a law running through all the grades of industrial neighborhoods, acting upon a sliding scale of descent in value in strict proportion to the decline of varied employments in the vicinity. And carrying in mind the fundamental fact that it is labor which gives his land all its value, he will desire more of it within the reach of his locality.

But it is diversification of productive labor within the sphere of his own business relations which most concerns him—diversification around him, that he may have at command diversification of the products of his own domain.

The world's work goes on somehow, however distributed, and consumption of farm products is a necessity of all men, wherever situated; but the farmer's welfare depends upon a demand that shall draw upon his own commodities, and in the greatest amount that he can supply. The supply is regulated by the demand, both in kinds and quantities. This plain proposition is so easily understood that it is familiar to every one. And just here the question of a home, as against a foreign, market comes up. The market across an ocean is as accessible to one producer as to another; for such things as may be carried so far, every farmer in the United States has a rival in every other, and in all Europe besides. Every wheat-growing country in the world is as near our only wheat-market in Europe as any State in the Union, and in most cases very much nearer, and in many of those countries the land is no dearer than ours is when brought to a high state of cultivation. The following tabular statement, taken from the English official reports, shows the relative value of the English market to us and to our foreign competitors. And here it is to be noted that we have no market for our breadstuffs and provisions in any country of Europe, except Great Britain and Ireland:

British imports of wheat and flour in equivalents of wheat.

Years.	From the United States.	From other countries.	United States per cent. of total imports.
	Cwt.	*Cwt.*	
1857–'60	19, 179, 442	73, 500, 165	20. 6
1861–'64	59, 322, 169	74, 556, 204	44. 3
1865–'68	16, 551, 507	113, 297, 540	12. 7
Total of twelve years	95, 053, 118	261, 353, 009	26. 66

This table, embracing our exports through a period of twelve years, shows how small is the comparative dependence of our only European customer upon our share of the required supply, but it still more strikingly shows the inconstancy of the demand, for here we have about three times more of our wheat and wheat-flour taken in the second group of years than in the first, and in the third group more than three and a half times less than in the second.

How does such fluctuation in the demand as this suit for the market of a product that must be provided a year in advance of its fate? But the price varies even worse than the demand; and always, when the larger quantity is taken, it is at proportionally lower rates. The prices of the wheat, in the foregoing table, ranged from $2.01 down to $1.40 per bushel, delivered in Liverpool and London—the larger quantity at the lower and the smaller at the higher price. The fluctuation shown in the group of four years does not express its extravagance, for the quantities of American wheat and flour imported into Great Britain have varied in the space of ten years from twenty-eight millions of bushels in one year to seven and three-quarter millions in another. If the home demand for any of his staples should fluctuate in quantity or price to such an extent as this, the farmer's business would be a lottery. And if it ever does vary so capriciously, it is owing to a foreign invasion of our own domestic-produce market.

This is a fair view of the American farmer's European market for his *exportable* provisions. But the most valuable and the most remunerative of all agricultural products are *not* exportable beyond seas, and only very partially transportable to any considerable distance at home. These include potatoes, beets, turnips, cabbages, all green vegetables raised in market-gardens, all orchard products, poultry, veal, mutton, milk, berries, fresh butter, and eggs. Every one knows that a neighborhood market for all these articles makes the difference between the price of land in the vicinity of a city and that of the remote districts of the West and South. Land yields roots by tons, wheat and corn only by the bushel. The United States Agricultural Report of 1870 gives a table showing "the average cash value of farm products per acre for the year 1870." In California, which stands highest in the list, corn is $42.72; wheat, $20.90; potatoes, $199.80. In Ohio, corn, $18.72; wheat, $15.04; potatoes, $58.32. In Pennsylvania, corn, $26.85; wheat, $15.24; potatoes, $67.86. The relative value of the yield of market-gardens is indicated by the products of a farm or tract of land of twenty-six acres in Rhode Island, including poultry, milk, calves, lambs, and the like easily associated things, from which corn, wheat, buckwheat, rye, oats, barley, and hay, for sale, are excluded, as shown by a yield in 1870 of $144.55 to the acre of the entire lot or tract. This farm under market-garden culture is in the vicinity of Newport, the fashionable watering-place; but a gentleman of Philadelphia, about twelve years ago, raised upon one acre, in the suburb of the city, carrots and cabbages, which he sold for $322. The average value of farm lands in the county was then $435 per acre. In 1870 they were held at $505.

We have said that a due diversification of farm products depends upon a neighborhood, or an easily accessible market, sustained by a complete diversification of other productive industries and vocations. This proposition is sufficiently proved by such facts as these: When a very extensive iron-mill was in process of erection at a distance of twenty-seven miles from Philadelphia, the proprietor was obliged to get the marketing for the employés in the city. The same thing occurs when a new hotel is started fifty miles from the city, in a neighborhood unused to, and therefore unprepared for, a home demand. In fact, there is nothing more remarkable or common than the scarcity of vegetables upon tables, otherwise well provided, in country places, too remote from any considerable market-town to keep up a constant demand for them. Nothing but such a demand will induce the supply, and farmers do not, because they cannot, extensively vary their products when they have not an inviting extent and variety of demand

from surrounding and neighboring industries. Two farmers can no more exchange with each other than two gold-diggers can—neither has anything that the other wants—but they can trade with a peddler, a blacksmith, a carpenter, a tailor, or a shoemaker; and their best and best paying products are always in demand by a neighboring factory, or college, or a city full of people engaged in pursuits wholly unlike their own. In such vicinities the corners of a worm-fence yield more values than the whole area of similar fields will do fifty miles away.

A universal principle of association and exchange rules here, as it does among all things, animate and inanimate, individual and social. Everywhere difference of quality, condition, capacity, or position, excites manifestations of force and exchanges of activities. In chemistry, combinations of correlated elements develop varied and multiplied powers in the atoms of matter, give rise to new forms and forces, with something that approaches the miraculous in the movements of nature. In astronomy, differences of position and magnitude produce and determine the motions of the celestial bodies. In terrestrial things, difference of temperature and electric conditions gives life and motion to the air and keeps up the circulation of the seas. Guyot, in his work entitled "Earth and Man," presents the universality of this principle effectively: "The differences are the condition of development: the mutual exchanges which are the consequences of these differences waken and manifest life. The greater the diversity of organs, the more active and superior is the life of the individual. The greater the variety of individualities and relations of a society of individuals, the greater, also, is the sum of life, the more universal is the development of life, the more complete, and of a more elevated order. But it is necessary, not only that life should unfold itself in all its richness by diversity, but that it exhibit itself in its utility, in its beauty, in its goodness, by *harmony*. Thus we recognize the proof of the old proverb, 'Variety in unity is perfection.'"

On the best and nearest home markets depend not only the greatest rotation of crops, but the best average chances of the seasons. Wheat and rye, corn, buckwheat, barley, and oats, which bear transportation to considerable distances, though with proportionate loss of value to the farmer, cover or extend over some varieties of season, and one or more of them may escape drought and diseases to which others are exposed. Every one knows that the chances of profit are increased in the ratio of these alternative reliances. From the same cause every additional vegetable adds to the probabilities of the year's expectations. Lettuce, spinach, cabbage, asparagus, tomatoes, berries, early fruits and roots, poultry, veal, mutton, milk, and a multitude of other products of the kitchen-garden, the orchard, and the barnyard, give a grand increase to the variety of products, extend the adaptation to the season, and so multiply the promising chances of the year; and these are available and possible only in the immediate neighborhood of large communities of people engaged in mining, mechanical, and manufacturing arts, with the commerce that attends the most multiplied and varied productive industries.

There is, of course, a difference between the supporting effect of a neighboring iron-mill, coal mine, or college, and a borough or a city; and this difference is another instance of the graduated operation of the law of diversification. The greatest variety in the demand reacts upon the agriculture of the vicinage, or of the market area, with exactly corresponding effects in educing a diversified production; and all the way down the scale of diversity of demand, the possibility of varied vegetable crops and animal products diminishes step by step. Hence the

governing principle of agricultural economy dictates to the tiller of the soil, who only wants a remunerating market to enable him to convert his raw acres into so many garden-patches, the policy of securing as great an extension and diversification of that market as he can. In doing so he not only promotes his own interests, but he serves in equal degree that of all the branches of converting industry engaged in effecting changes in the forms of raw materials, which, in large measure, the cultivator produces by his own labor from his own domain. The farms of the North and the plantations of the South yield the whole of the material of our domestic textile fabrics. Of the leading manufactures reported in 1860,* amounting in value of products to $1,129,000,000, only $214,000,000 worth were produced from metals and other minerals; while those manufactures which derive their materials from the vegetable products of the country reach a value of $915,000,000. Of these last products the general average of the raw material, taken at 54 per cent. of the value of the finished commodities, gives $494,000,000 as the agriculturists' share in the total of these manufactured commodities. To this sum must be added the food supplied to the laborers employed in all these manufactures, which may be roughly estimated, and certainly not overvalued, at 40 per cent. of the total wages paid upon the production of the leading manufactures here considered. This gives us $91,000,000. Add this sum to the farmers' and planters' interest in the raw material used, and we have as the result $585,000,000, which is $21,000,000 more than half the total value; showing that our agriculturists are fairly even partners with our manufacturers in their chief and leading industries. With respect to the $756,000,000 worth of manufactured products of 1860, not embraced in our calculations, (because it would require too much labor,) it is safe to assume that the two grand branches of our national industry are about equally divided in interest. Indeed, it is fairly presumable that the agricultural interest, on the whole, very considerably predominates, for this reason: the average proportion of raw materials to the total of finished goods and wares is 54 per cent.; but the raw material of the commodities of vegetable origin is much larger in proportion to the value of the finished product than are the raw materials of the products of a metallic and mineral basis. Our calculations are roughly but safely made, and we are well satisfied that the agriculturists are much more than equal partners in the total products of our manufacturing industries. From all which we derive the proof of not only a close inter-dependence for their existence, but an equal pecuniary interest of the two great divisions of productive labor; and from this economic mutuality is seen the wisdom of harmony and co-operation in policy. Hostility of feeling or act between them arises only from ignorance, or prejudice based in ignorance; and the theorists and demagogues who would stimulate such a conflict are either blind guides or self-seeking impostors, or both together. These professional authors, editors, and politicians are, moreover, remarkable for fomenting animosity between the North and the South, and between the East and West, of their own country, when they *are* our countrymen, while they preach peace, unity, mutuality, and a common policy of industry and commerce with all foreign nations. Disturbers of the harmony of their own family are badly qualified for pacificators of all the world outside with the nation at home.

* The preparation of this paper being required before the publication of the census report upon the manufactures of the Union for 1870, we have been obliged to resort to that of 1860 for the data of these calculations.

This unity and mutuality of interest of the parties—only too often arrayed against each other—and the equal dependence of each upon the other need only to be stated as to the manufacturers' dependence upon the agriculturists who carry on their industry and furnish supplies from an easy distance. Much of the provisions required cannot be imported from foreign countries, and none of them, not even breadstuffs and meats, at a remunerating price to the producers. Where water-carriage serves, some of the heavier kinds of food will bear to be brought farther, but any other mode of transportation leaves little to the far-away farmer of the price that the manufacturer can possibly afford. The higher-priced raw materials, such as silk, cotton, and wool, will bear the cost of transportation, but the heavy, bulky, and low-priced cannot without increasing their cost out of all proportion to their resulting market value; and, for these reasons, the majority, in kind and value, of manufactures must depend for their supplies upon the neighborhood or upon an area of available nearness.

England does succeed in the manufacture of cotton brought from beyond seas, but at a frightful cost of suffering to her laborers, which reacts upon her people in reducing 10 per cent. of them to absolute pauperism; and when all those are considered who are fighting poverty hopelessly on the verge of destitution, the number, according to the estimates of the best informed British authorities, amounts to about five millions of the people, which is one-third of the manual-labor class. This is the worked-out result of a system of industry that depends for full four-fifths of its raw material and one-fourth of its breadstuffs and provisions upon a foreign, and, in the main, a trans-marine supply. Under this system Ireland, upon which the burden has fallen most heavily, has declined 2,820,000 in population since 1841, with the natural increase of at least 1,400,000, also lost. Thus it has starved, killed, and banished full 50 per cent. of the Irish people in thirty years; and all this has been done as a necessity under the policy of importing foreign raw material, to be manufactured for foreign markets! Low wages must be forced to the edge of starvation in England, driving Irish labor still lower, the fearful competition of approaching destitution being used to hold down the rate of wages low enough to command the foreign markets, which the system struggles for. This is what it eventually costs to a people who persistently violate the law of trade between nations; a law that limits exchanges to *natural* differences of their respective products—a law of climate, making *supplementary* exchanges necessary, and therefore right and orderly, allowing, however, a temporary accommodation of nations in the infancy of the arts, by which they are for the time rendered incapable of self-supply, but fixing the limits of commerce rigidly at these natural boundaries; the consequences of transgression, as sure as those of any other natural law, being a measure of suffering to the aggressor, proportioned to the injury inflicted upon the victim.

The necessary order of human affairs is thus vindicated, and the command, "Thou shalt not steal," is extended from the covetousness of the individual to the arrogant invasion of the labor-market of nations, robbing them of all the good fruits of self-support and self-development. Such considerations as these show how law rules in binding the manufacturer in the bonds of reciprocal help, by forcing him into a convenient proximity to the sources of his supplies or punishing all the parties concerned in its infraction.

On the other hand, the dependence of the cultivator of the soil upon the skilled converter of his products into the infinite forms of use re-

quired for the service of human life, in its progress to the highest civilization, appears in the following, among other considerations, which we submit as briefly as clearness allows:

No purely agricultural people, or people limiting their mechanical occupations to the rude necessities of their daily labor, ever were able to support a commercial marine. One great branch of industry necessary to economic independence they cannot have; they cannot be the carriers of their own necessary international exchanges. The greatest manufacturing nations in all time have been, and are, those which have the greatest peaceful command of the seas. Accidents apart, a nation of well-balanced and harmonized industrial interests will always have their own trade, with all its profits and securities, in their own hands.

As an instance, and a striking one, it will be remembered that in the twenty years before the rebellion, the restive South, under the impression that the northern monopoly of the carrying trade despoiled them of the greater part of the natural profits of their great staples, endeavored to establish direct navigation of their own with Europe. For this purpose they held numerous conventions, endeavoring by all the incitements of secession-tending patriotism, and all the promised profits of a separate and independent trade, to become heated up to enthusiastic and passionate resistance to commercial oppression; and all without any result whatever but repeated failures. Landlords are not sea-lords. They can neither have the spare capital, the constructive skill, the nautical art, nor the enterprise that make the sea a highway for trade and travel. The husbandmen, whose sole business it is to plow the soil, will find themselves abroad when they undertake to plow the sea. The South, neglecting all other territorial improvements, exhausted their resources and capabilities when they constructed their railroads, to which they were compelled by their system of business. This system looked to carrying everything abroad that they produced and bringing everything back that they needed to consume. With them, labor was not for the benefit of the laborer or of the land. Home commerce was nothing; exports and imports were everything; exhaustion of the soil, and expatriation of whatever of enterprise grew up among them were the inevitable result. A grand system of exporting nothing but raw material and raw men, and importing the results of skilled labor from abroad, or from a distance, and leaving their own capability for it wasted and uncultivated could not result otherwise. They even extended their foreign dependency by continuous annexation of new territory, having already virtually exported the land that they lived on, and history, in the extreme youth of that people, has recorded the result! Those men or that people only can do an extensive business with others who have a basis of secured resources and a fair independence of their own.

A merely agricultural people cannot ever have anything that deserves to be called an agriculture. They can rob the soil of its fertility, but they cannot cultivate it. They have no home market, and can produce nothing but the coarsest and crudest products, and, sending all their products abroad, they cannot refresh the energy of their lands by returning to them a fair portion of their products after they have served their human uses. So their account runs out at last in a bank in which they make no deposits.

But the most wretched failure of all in an agriculture unrelieved and unsupported by due admixture with manufacturing labor, is its liability to famines and their attendant plagues. In all past time, previous to the modern development of the useful arts, the history of nations is crowded with the constantly recurring instances of wide-spread destitu-

tion, disease, and death. But no famine or great scarcity has visited any parts of Europe within the present century, except those which have not even a tolerably diversified system of productive industry. Ireland has sixteen millions of arable acres,* but ten millions are in pasture. The mass of the people are confined for food to a single root, which, under the pressure of necessity, is stimulated into disease; and in that country famines frequently occur, and deficiency of food constantly lingers, while happier lands in her neighborhood have an almost complete exemption. In the great famine years, 1846-'47-'48, England and Wales had just double her density of population, and their soil is not more capable than hers; but under the terms of the union with Great Britain, which went into full operation in 1821, the Irish manufactures languished rapidly into exhaustion. Thereupon followed the famine of 1822, that of 1832, and the still more terrible one beginning in 1846, increasing until 1848, and lingering and devastating the population until 1851. The people had been confined to agriculture and pasturage almost exclusively, rents rose to the starvation point, and two or three unfavorable seasons in succession brought the mass of the industrial community into the situation which Thackeray thus describes: "In the fairest and richest counties men are suffering and starving by millions. There are thousands of them, at this minute, stretched in the sunshine at their cabin-doors, with *no work*, scarcely any food, no hope, seemingly. Strong countrymen are lying in bed 'for the hunger;' because a man lying on his back does not need so much food as a person a-foot." And this state of things continued, though somewhat abated, until nearly three millions out of eight had perished, or were driven from the land of their birth, within fourteen years.

India, also, is still frequently visited by famines; but is it surprising if the richest soil of the world fails to yield its harvests, when the rule of the foreigner, or whatever else is the cause, has restored the jungles of tropical luxuriance to the very garden-grounds of the Deccan, and tiger-hunts are the pastimes in spots which still retain the vestiges of demolished palaces and villas?

But what caused such desolation as this? The trade of India was thrown open in 1813 to free competition. A little while before, that country abounded in cotton, and the labor of men, women, and children was employed to such an extent in the work of converting it into cloth that they not only supplied the home demand for the fine tissues of Dacca and the coarse products of Western India, but exported to other parts of the world no less than two hundred millions of pounds of cloth per annum; but after the commencement of that free competition, the poor people were exposed to the rivalry in their own markets of a nation possessed of machinery greatly more effective than their own. The invaders of their labor-market went still further: for the very purpose of utterly extinguishing their skilled industries, they taxed every loom in India, and every machine calculated to aid the laborer, increasing the rate with every increase in the industry of its owner, and generally absorbing all the profit arising from its use. The result of all this was that in twenty years the export of cottons had entirely ceased; and, having destroyed the foreign market of India, England proceeded to take possession of its domestic market. For this purpose "*children* were worked in the cotton-mills of Lancashire from fifteen to seventeen hours per day during the week, and on Sunday morning from 6 until 12 o'clock, in cleaning the machinery."

* The State of New York has now almost exactly the same area of improved lands, and a population equal to quite four-fifths of that of Ireland.

So the multitudes that formerly filled all the channels of foreign commerce with their manufactures were driven back to exclusive agriculture, the production of raw cotton being the chief staple, which, with opium, indigo, hemp, rice, and wool, in 1863, amounted to £41,000,000, out of a total export of £48,500,000. In the list of these exports the hemp is undressed, the rice is in the husk, the hides are not tanned; only the goat and sheep skins are dressed; £112,698 worth of manufactured silk appears in the exports, and while the cotton manufactures are only £92,053, the elephants' teeth amount to £70,013.

India has worked out our problem to a demonstration. In her happier days her industries were diversified, in advance of all the world, and her agriculture kept abreast of her manufactures. In the early years of the present century her manufactures commenced a rapid decline, going on to nearly absolute extinction. Mr. Thompson, in his "Lectures on India," finishes the picture that tells the story with such dashes as these: "Some of the finest tracts of land have been forsaken and given up to the untamed beasts of the jungle. The *motives to industry have been destroyed.* The soil seems to lie under a curse. Instead of yielding abundance for the wants of its own population and the inhabitants of other regions, it does not keep in existence its own children. It becomes the burying-place of millions, who die upon its bosom crying for bread. In proof of this, turn your eyes backward upon the scenes of the past year, (1838.) Go with me into the northwestern provinces of the Bengal presidency, and I will show you the bleaching skeletons of five hundred thousand human beings, who perished of hunger in the space of a few short months. Yes, died of hunger in what has been justly called the granary of the world. * * * This carnival of death occurred in India, in the reign of Victoria the First! Nor was the event extraordinary and unforeseen. Far from it; 1835–'36 witnessed a famine in the northern provinces; 1833 beheld one to the eastward; 1822–'23 saw one in the Deccan. They have continued to increase in frequency and extent under our sway for more than half a century."

In Persia such a famine has prevailed since July, 1871, as can happen nowhere else than in a country of unmixed and unsupported agriculture. We have such accounts of it as these: "The fate of Persia, in view of the recent accounts of the continuance of the famine, is apparently that of extinction. Sir Henry Rawlinson, in a late address in London, spoke of it as a doomed country." A letter dated Teheran, August 7, 1871, in the Cologne Gazette, states that pestilence and famine make the situation in Persia more horrible from day to day. Of the 120,000 inhabitants of Meschad, the capital of Khorasan, two-thirds perished from hunger and disease in July last. At Ispahan, the capital, there have been 12,000 deaths from starvation and disease engendered by want. The population of one town, Kazeroon, has fallen from 10,000 to 2,000—4,000 died and 4,000 fled.

In January, 1872, a telegram from London says: "Official advices from Ispahan show that the famine in Persia continues, and suffering and desolation are undiminished. Entire districts of that country are depopulated, and the distress in the cities is terrible." The immediate causes are thus assigned by the Allgemeine Zeitung: "Agriculture in Persia is in a very primitive state; the want of water is so great that the fields have to be irrigated. The peasant seldom cultivates more than what is required for his household. There is, consequently, never any considerable surplus of grain, and the results of a bad harvest are terrible. * * * If we consider the difficulty of communication—the roads of Persia being narrow paths, trodden down by horses,

asses, and camels, carts being almost unknown—it will be understood that the accounts of the famine, published in the papers, are substantially true."

These people, and the historic land which they now occupy or incumber, have in times past had a very different portraiture. From Murray's Encyclopedia of Geography we gather such features as these: "The Persians are an active and laborious people, and if all the branches of national industry are now (1838) in a low state, it is owing only to the anarchy of the government and the inroads of predatory tribes. In regard to agriculture, the country labors under considerable disadvantages from defective irrigation. This evil, however, in the better days of Persia, was in some degree obviated by artificial irrigation; and at all times the plains of Shiraz and Ispahan and the provinces on the Caspian have displayed an exuberant fertility." He speaks of the cereals produced as those chiefly cultivated in Europe, particularly wheat, and of the fruits as celebrated for their excellence; of the vine as the pride of Persia, and the wine of Shiraz as worthy of its poetic praise. The mulberry-tree formerly supplied them with silks for an extensive export, and the great capacity of these regions for the production of cane sugar is well-known. The excellence of the pasturage has enabled them to take the lead even of the Arabians in the rearing of horses. Sheep are bred in great numbers. Their wool forms the basis of the finest manufactures and their goats yield a wool which nearly approaches the Cashmere in quality. Their Persian carpets, which are called Turkey from the place of their importation into Europe, and other and finer ones, have been celebrated throughout the East in the better days of the nation. They once abounded in silk tissues, exceedingly fine and beautiful. They excelled in the manufacture of arms, and their earthenware was not only very extensive, but some of the products rivalled the porcelain of China; these, with shawls made from goats' wool, leather, paper, and jewelry, figure grandly in the past history of her principal manufactures.

These, and such as these, have been the products of Persia as she has been, and such are her capabilities now. Murray ascribes her decline to bad government and the invasions of predatory hordes. But what has brought these evils upon a people the most opulent and powerful in the old-time history of Asia? Let us see. McCulloch, in his Dictionary of Commerce, tells the story, though he does not intend to do so, nor does he probably understand its bearing. According to him, Persia imports its steel from India and cotton goods from England, which, he says, though inferior in color, are now superseding all others, and from the rapidly-extending demand are capable of an indefinite increase. Other cottons are imported from Switzerland and Germany. Woolen goods, cutlery, watches, &c., sent from England to India, are thence exported to Persia, through the principal seaport of the Gulf, and English imitation shawls meet a fair sale. Their paper is now obtained from Russia. Thus the principal products of skilled industry consumed in this now famine-stricken country are of foreign origin.

Now look at the exports. Raw silk is the most important of them: dried fruits and dates to India; horses, in large numbers, by sea and land, to India, for the use of the English cavalry and for the market there; tobacco and dye-berries, which are highly esteemed in Turkey; some drugs and goats' wool, almost as fine as that of Thibet. Cotton is extensively produced and is exported to Russia; grain in small quantities to Muscat. The manufactured articles which they send abroad are chiefly of silk, such as velvets and gold and silver brocades. The shawls

are in the main brought from Cashmere; to these must be added only their carpets.

This report of Persian industry is a sufficient explanation of the great calamity that has now fallen in accumulated force upon her people. They have not for many years had a sufficient variety of skilled occupations to keep their agriculture alive; not enough of resources and of energy to maintain and employ the canals that formerly supplied their soil with water; and not a sufficient demand for its products from the naturally associated mechanical and manufacturing arts around them, to induce an agriculture beyond a hand-to-mouth consumption.

We need not further multiply instances, or give more than a glance at the famine in Northeast Prussia, which occurred five or six years ago; and we notice that, only because it was a case of destitution of food in a region given up totally to the production of food, though surrounded by neighboring districts having a better organized system of labor, enjoying abundance at the same time. The whole argument may be safely rested upon the fact that famines, or even scarcity, never occur anywhere except in regions that are almost entirely devoted to the production of *food.* The crop of one year never suffices for itself and the next following. If that of the last greatly fails, a short allowance results, and another lean year at the heels of the second brings actual and general starvation.

These facts lead directly to the inference, that duly diversified industry is an insurance against such calamities. We believe, moreover, that we have found the law of the relation between agriculture on the one part, and the mining, mechanical, and manufacturing arts on the other, which governs every degree of their respective development, of their interlinked prosperity, and of their inseparable fate in diminution and decay. This law, moreover, is so obvious to thoughtful observers, that we find it distinctly announced twenty-three hundred years ago by Xenophon, of whom it is recorded that he urged upon his Athenian countrymen that, the *domestic market* for food having been ruined by neglect of a proper development of the mineral treasures with which their soil abounded, *agriculture had become impossible;* many becoming usurers or brokers, because they had been forced to abandon it. And ninety-six years ago we have an explicit and formal statement of the dependence of agriculture upon the mining and manufacturing industries by the acknowledged father of political economy: "The greatest and most important branch of the commerce of every nation," he says, "is that which is carried on between the inhabitants of the town and those of the country. The inhabitants of the town draw from the country the rude produce which constitutes both the materials of their work and the fund of their subsistence; and they pay for this rude produce by sending back to the country a certain portion of it manufactured and prepared for immediate use." And he adds emphatically: "Whatever tends to diminish, in any country, the number of artificers and manufacturers, tends to diminish the *home market, the most important of all markets,* for the rude produce of the land, and thereby still further to discourage agriculture."—(*Adam Smith's Wealth of Nations,* book IV, chapter 9.)

The drift of all the movements in business which tend to enhance the value of lands, under the influence of increased demand for its products in quantity and variety, and the increase of the mechanic and manufacturing occupations, on which that of agriculture depends, starts the question of *cost and profit* involved in the process, which, unfortunately, is usually considered as a question of *prices,* or comparative prices in

the market-place. Our first and broadest answer to the conclusions drawn from this easy and popular species of logic is, that the question is one of progress—moral, social, and economical—a question of advancement of the welfare of individuals and communities. Advancement of the general welfare in any and every degree depends upon a favoring diversification of the wealth-producing industries of a community, simply because in the first place this is the only means of finding employment adapted to every faculty of the infinitely varied individuals of which a community is composed—a necessary condition of a university education in the useful and fine arts, and of a sufficiently large choice of occupation to secure the opportunities for freedom in domestic labor. It is obvious, for instance, that where tillage and pasturage are the only occupations open to a people, as now in Persia, India, and Ireland, and as they are to a certain extent in the very earliest days of the settlement of our own new Territories, the liberty of choice is extremely limited, and every man is every other man's competitor in the market, and the hucksters and transporters have it all their own way in securing the avails. This is not the manufacturing system, of which the agriculturist mistakenly complains as his enemy, but the commercial system which, because he needs it as a servant, he accepts as his master. This policy, or this condition of things, which can scarcely ever be a policy, because it is never a matter of free choice, being a violation of the natural harmony of all the productive industries, exposes its subjects to the rule of that other class of business people who are occupied merely with the distribution of the products of labor, which gives no other or greater additional value to them than that of changing their place. The mercantile function is, in the normal order of things, a subsidiary service. In an undiversified fragmentary system of industry, it becomes dominant and a tyrannical power. Its rule of trade requires severance and distance; but the commerce of a true order of things excludes the middleman in the degree that consumer and producer are brought into nearness of place and ability to have direct exchange. It is obvious that the question of prices—nominal market-prices—cannot be allowed to take precedence of real values in the economy of business exchanges. Secure the true order and relation of all the industries, and prices can have no place in the settlement of policy, for real or normal prices must follow and be governed in harmony with such economic order, and never can become the master-wheel in the machinery. Moreover, if, as we have argued, land and labor must enhance in value, and therefore in price in the regular order of things, and if such enhancement of prices is a necessary condition of economic progress, the consumers, among whom the artisans of the community and the capitalist employers fill the largest place, must not complain; for their business, their labor, and their profits all depend upon the condition of things which produces such enhancement in price of the raw materials and food which they use. We say enhancement of price, not of *value*, for this is due to the utilization of the raw material and the consumption of food, which the manufacturer himself occasions, and without which the increased value of the one and the increased production of the other could not occur.

The class of consumers of agricultural products and raw materials cannot, without stultifying themselves, complain that these when produced in the neighborhood are doubled or tripled in price to them above the rates that they hold at a considerable distance, or in a region of the simplest forms of labor. This is a necessary result of their own business prosperity; without it their occupation, like Othello's, is gone.

In like manner and for the very same reasons, any enhancement of the price of manufactured commodities which may be necessary to the encouragement and support of their production within the market area of the farmer's most profitable products, is at the same time a necessary condition of his business extension and diversification. If he might for the time purchase commodities, manufactured beyond the range of market for his own produce, something cheaper in money price, he must lose the difference, and usually much more in the reduced value of his land and of its aggregate yield. So that, whether considered in respect to the general effect upon common welfare, the progress in civilization, or immediate results in trade, prices are not the ruling element in a wise business economy. But the parallel between the mutual interests of the two great branches of productive pursuits does not hold throughout. They part company in the progress of their welfare. The price of land and its products continually enhances under the influence of the system that most favors them; while the prices of the products of mechancial labor and capital as invariably decline. The products of land—of its minerals, timber, and crops—and the rewards of labor gain in advancing conditions of the community, and gain in due proportion to the growth of those industries which surround them. Prosperity prevailing, the prices of land and its products and the wages of labor rise, because both are improved; but the commodities of handicraft and machinery decline in price in inverse proportion to the improvement of the agencies which they employ. As an instance and proof, if any be required: The official reports of British foreign trade show that of all the multiform products of British manufactures exported, as much might be bought in the year 1852, for $1 as $2.50 would purchase in 1817. Breadstuffs and provisions cannot be multiplied by the intervention of machinery and the appliances of science, capital, and industry, in any proportion to the miraculous increase of metallic and textile fabrics. Value being the measure of the resistance of nature to human dominion, or the cost of production at the time of the sale or exchange, it is manifest that the farmer's property, fixed in the soil and minerals, and movable in animal and vegetable products, must always relatively, and often absolutely, hold a high and ever-growing higher rate in comparison with the commodities which converting skill has for its subjects.*

The one is concerned with the vital laws of animal and vegetable substances, which cannot be completely subjected to control, while the other deals only with the chemical and mechanical properties of dead matter, which is without power of resistance.

We have been tempted throughout this discussion to distinguish the labor of artisans from that of tillers of the soil by the use of the terms *skilled* and *unskilled*. Such definitions are in some degree warranted by the much greater perfection that the one has attained in its province, than the other has yet achieved in the management of its subjects. In natural rank, agriculture is the higher, because its products are the prime necessaries of life, because it was before all other arts, and because it is destined to involve and employ a science which shall be a summary of the vegetable and animal economy, and embrace,

* The cereals used for human food, being subject to the influence of the seasons and to diseases from various causes, are, year by year, or at short intervals, liable to greater fluctations in price than any other necessaries of life. Taken at longer periods and in similar circumstances, the price is found to remain about the same through the lapse of two centuries. Flesh meat has steadily grown dearer, and table vegetables and fruits can scarcely be compared with old-time prices, for they first appeared in use or market at a comparatively late date; but they have risen in quality and value prodigiously since they began to figure in the prices-current of the market.

besides, meteorology, geology, and the chemistry of the live earth which it cultivates, of the air and the waters, and it may be that in time it will add the influences of the planets and stars. This eminence once attained, it will be a skilled art in a greatly higher sense than those which deal only with the chemical and mechanical forces of inanimate matter. But, just because it is destined to the highest rank and to embrace so many contributing departments of science and art, it depends, through the whole progress of its development, upon the support of its natural auxiliaries—upon all branches of knowledge and labor that are available for its service and advancement—another view and another corroboration of its dependence upon the industries which are its handmaids, none the less that they have at the outset attained more knowledge and power in their easier spheres of service than as yet their royal mistress has achieved.

MOULE'S EARTH-CLOSET SYSTEM.

The cleansing of farmers' homes and the preservation of the most valuable manure that is made on the farm are subjects to which the attention of all who live in the country, and of all who cultivate the soil, may most profitably be given. If any are disposed to question the suggestion that farmers' homes are in need of cleansing, in a country that prides itself as much as ours does on its civilization, it will surely not be those who know the details of the mode of life in the average farmer's house, in even the oldest settled parts of the country. We have become familiarized with customs that have always prevailed, and we need to have their defects pointed out to us. The fear is that, even after we recognize them as defects, we shall fall back into our old endurance of them, on the principle of "leaving well enough alone," which sometimes means that we blind ourselves to evils we have learned to bear. The necessity of a reform, for its sanitary and economic results, and its influence in the direction of decency and refinement, is so urgent that it is deemed proper to employ the 255,000 issues of this report in presenting fully what has obtained only partial recognition since this discovery has been promulgated in this country by Mr. Geo. E. Waring, jr., of Ogden Farm, Newport, Rhode Island, whose aid has been invoked in the preparation of this paper.

The wastefulness and the danger of our present system are frightful to contemplate, but we keep ourselves comfortable by not contemplating them. The actual condition of at least too many of our farm-houses is very much as follows: Not far from the kitchen-door there is a gentle declivity, leading often to a basin-like pool near at hand, down which there flows an almost perennial stream of whitened slops, containing all manner of soapy wastes and similar liquids, that cannot be turned to profitable account in the hog-pen. Sometimes the influence of modern ideas has gone so far as to cause a drain to be made to convey these slops a rod or two away from the house, there to accumulate as before, filling the soil and the air with their offensiveness. The desire (and a praiseworthy one it is) to save labor to the over-worked females of the family reduces the accommodation for all manner of liquid wastes to the least that is possible in all the bed-rooms of the house; indeed, water is very sparingly used on the upper floor, even for washing, and the usual means for getting it down stairs when it has been used is to throw it out at

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the window, suggestive stains discoloring the sides of many an otherwise well-kept house, beneath the windows, especially of the men's bedrooms. At the bottom of the garden, or at some other inconvenient distance, stands—a temple of defame—the common privy of the establishment, covering a stifling vault, from the accumulations of which there arises in warm weather the vilest air to which the human senses have ever learned to accommodate themselves; while in winter the cold blasts that find easy passage through the loose foundation rise through the seat, causing infinite discomfort and danger to health. This necessary resort, even of delicate women, whose condition should command our greatest care, is approached by a path that is often blocked up with snow, deep with mud, or overhung with dripping trees, or overgrown with wet grass.

If the house is in a village, this walk is probably so exposed to the public gaze that women are often tempted to postpone their visits until nightfall. This and the neglect that comes of the dislike to encounter cold and wet are fertile causes of the ill-health for which country women are especially noted.

Taking the whole country into consideration, the conditions described above are certainly as good as the average in the case of those who live on farms and in small towns—probably better than the average—and they indicate how far we fall short of being a civilized people. It is true that our middle and lower classes are better fed than those of most other countries, or at least they would be if they knew how properly to cook and serve the excellent raw material with which they are supplied; that they are very much more handsomely and perhaps more comfortably clothed; that their houses are better furnished; that they have much more than the average facilities for education; and that they have, on many subjects, much more than the average intelligence. Their progress in these respects has been all that could be hoped for. But, for all this, they not only lack some of the most important comforts and decencies of life; they do not even know that they lack them; and their false sense of delicacy is generally very much shocked, if we tell them precisely what they lack. With bodies that are susceptible to the poisonous influences of putrefying filth, with their health more or less constantly subject to these influences, and with their hearts torn by the loss of friends who have fallen victims to malarial diseases, they live on, indifferent to, if not ignorant of, the dangers and discomforts that surround them. They are busy in accumulating the means for more luxury while they remain blind to improvements which, costing comparatively little, would prolong their lives, secure exemption from disease, and make their homes much more fit abodes for an intelligent and prosperous people.

To illustrate more exactly what is meant, it is only necessary to refer to the personal care of the sick. Of all the duties that devolve upon us, none are at once so barbarous and so distressing as that which even the most delicate and refined persons are called on to perform in the offices of the sick chamber, distressing alike to the patient and to the attendant. We surround our suffering friends with every comfort to which we are accustomed, and try in every usual way to alleviate their pain and to provide delicacies and luxurious surroundings, to make them feel our love for them, yet we neglect a simple precaution that, costing less trouble than the gathering of a bunch of flowers for their bedsides, would save them and ourselves from an offense for which our best efforts in other respects are a poor compensation.

Surely it is not too much to say that no house, however well appointed

in other respects, is a fit abode for civilized women, nor a fit place in which to bring up their children, that is not supplied with the simple conveniences that will enable them to attend to the calls of nature without exposing themselves to the public gaze, to the inclemency of the weather, and to the foul odors of a common privy. This is plain language, as the subject demands. Leaving out all other considerations, the proposed reform should secure the best efforts of all sensible men and women, for the single reason that it will secure relief from an evil, our tolerance of which almost justifies Mr. Darwin's theory of our origin.

THE QUESTION OF HEALTH.

But other considerations are no less important. They are considerations of fact rather than of sentiment; but when they come to be appreciated, they will be seen to have a crowning force. They are: 1. The question of health. 2. The question of economy. The sanitary question is placed first, because, however carefully we may practice economy and increase material prosperity, we shall profit little if we have not the health to enjoy our possessions, and because the most important item of the wealth of a nation is its population. Great prosperity comes of the works of great numbers, and anything that tends to lower the death-rate, and so increase the rapidity with which population is multiplied, will have a controlling influence on the accumulation of wealth by the development of national resources.

We have not, as yet, in this country sufficient statistics on which to base a reliable computation, nor, perhaps, would it be possible to form, from the vital statistics of any country, an exact estimate of the influence of any given class of causes in producing death. At the same time there are on record striking instances to show how directly fatal the poisonous exhalations of domestic filth may be.

In a report made by the general board of health, concerning certain improvements in London, it is stated that in Lambeth Square, occupied by a superior class of operatives, in the receipt of high wages, the deaths, which in ordinary times were above the general average, or more than 30 in 1,000, had risen to a rate of 55 in 1,000. By the abolishing of cess-pools, which were within the houses, and the substitution of water-closets, and with the introduction of tubular, self-cleansing house-drains, the mortality has been reduced to 13 in 1,000.

The reduction of the mortality was effected precisely among the same occupants without any change in their habits whatever.

Sewers are less important than the house-drains and water-closets, and, if not carrying much water, may become cess-pools. In the case of the square just referred to, when cess-pools and drains of deposit were removed without any alteration whatever in the adjacent sewers, fevers disappeared from house to house as these receptacles were filled up, and the water-closet apparatus substituted, merely in consequence of the removal of the decomposing matter from beneath the houses to a distant sewer of deposit or open water-course.

If the mortality were at the same rate as in the model dwellings, or in the improved dwellings, in Lambeth Square, the annual deaths for the whole of the metropolis would be 25,000 less, and for the whole of England and Wales 170,000 less than the actual deaths.

If the reduced rate of mortality in these dwellings should continue—and there appears to be no reason to suppose that it will not—the extension to all towns which have been affected, of the improvements which have been applied in these buildings, would raise the average age at death to about forty-eight, instead of twenty-nine, the present average age at death of the inhabitants of towns in all England and Wales.

Of course, nothing in our smaller towns or in the country at all comparable with the conditions existing in Lambeth Square can be found; but the very remarkable improvement of health that followed the puri-

fication of those houses points plainly to the danger of allowing such offensive accumulations to exist, where their influence can reach our own dwellings.

Another instance in this country may be cited as having a more direct bearing on the circumstances of which we speak:

Pittsfield (Massachusetts) stands high up in a mountainous country, with every natural condition that could be asked for perfect healthfulness. Probably there are few healthier towns in America. In the outskirts of the town stands the Maplewood Young Ladies' Institute, a school that had long been noted for the salubrity of its situation, and was in all respects of good repute.

In 1864 many of the inmates of this school were attacked with typhoid fever, under circumstances that induced the appointment of a committee, consisting of Drs. A. B. Palmer, C. L. Ford, and Pliny Earle, (professors in the Berkshire Medical College.) The following extracts are taken from their report:

For the purpose of presenting some facts in the order in which they occurred, and because subsequent events seem to make this statement necessary, we would here say, though somewhat out of logical order, that during the time which had elapsed between the closing of the term, on the 10th of August, and our visit of inspection, on the 20th of September, great changes, in accordance, it is alleged, with previous plans, had been effected at Maplewood. The old corridors, to which we shall hereafter refer, had been replaced by entirely new ones, lighted, elevated, and much improved in construction. The privies or vaults, hereafter to be described, had been completely removed, even to their foundation-stones, together with earth which was around them, and their places obliterated by freshly-drawn earth, while others of proper construction had been substituted. Some new drains had been dug, and a large and deep cess-pool, at a considerable distance from the buildings, was being constructed, to receive the slops of the kitchen, the chambers, and the laundry. The ground near the buildings, from which a barn had been removed during the warm season, had been for the most part deeply covered with fresh, clean earth. An offensive pool in the barn-yard had been filled up. Lime had been freely scattered, the building within had been well washed, ventilated, and disinfected by lime, and the furniture freely exposed to air and light.

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Our special inquiries embraced seventy-seven pupils, the entire number who boarded and roomed in the seminary buildings during the last month of the term. Replies to the circular were received from seventy-four pupils or their friends; and from these replies it appears that fifty-one have had typhoid fever, including those cases of pupils residing in the house already referred to. The disease has been pronounced "typhoid fever," with singular uniformity, from sources widely remote, in the many distant homes to which the pupils repaired. Three or four were reported of a mild form, such as would be called by some authors "abortive typhus;" but a very large proportion of the cases are represented as severe in form and continuing for several weeks. Of the twenty-three not reported as having had typhoid fever, nine or ten had, in a milder form, premonitory symptoms, which speedily yielded to treatment; one had dysentery; one reported "slow fever;" one "anæmia;" two "unwell," nature of case not stated; and eight reported themselves as "well" in the institute, and for a short time afterward. Of the fifty-one cases of typhoid fever among the pupils, thirteen terminated fatally, or about 25.5 per cent. The remainder have more or less perfectly recovered.

The very large proportion of so great a number of persons being ill, and having typhoid fever within so short a period, points unequivocally to something peculiar in their condition; to their exposure to noxious influences of some kind, either in their locality, their diet, or their habits. This will be more strikingly seen when the sanitary condition of these persons is compared with that of the community at large, by which they were surrounded. Of the seventy-four resident pupils heard from, sixty-six are reported as having had illness of some kind at the close of the school, or soon after. This is a proportion of thirty-three thirty-sevenths, or nearly 90 per cent. Of these same seventy-four, fifty-one had typhoid fever, or a proportion of nearly 69 per cent. If all the people in the town—say eight thousand—had been affected in an equal proportion, more than seven thousand would have been ill during these few weeks, and about five thousand five hundred of them would have had typhoid fever; and of these over one thousand three hundred and seventy-five would have died. If it would be a more just comparison to take the whole family at Maplewood into the account, estimating the number at one hundred and twelve, fifty-six had typhoid fever, or 50 per cent.; and of these fifty-six, sixteen died, or over 28.5 per cent. These proportions, applied to the whole population of eight thousand, would give four thousand of typhoid

fever in the same time; and of these one thousand one hundred and forty would have died. According to the testimony of the practicing physicians of Pittsfield, the number of cases of real typhoid fever during this period, aside from those affected by the influences at Maplewood, was small; some physicians not having had any, others having had two or three.

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A few rods east of the northeast corner of the east building was situated, until removed in July, a barn which had been there for many years, and the barn-yard, which extended toward the east building, was in part lower than the surrounding ground, containing water in which swine were reported to have wallowed and which frequently emitted offensive odors. The kitchen-drain opened some eighty or ninety feet from the corner of the building; and though an attempt was made by a temporary expedient to cover the course of the stream of slops flowing from the large kitchen, it was but partially effected, and in the hot weather unpleasant odors issued from this source.

The drain from the laundry under the west building opened upon the surface of the ground fifty-six paces southwest from the southwest corner of the building, and thirty feet from the sidewalk of the public street; and the water from it, after being detained and partially absorbed, as alleged by the principal, in a large covered cess-pool, issued at the point before mentioned, sometimes, at least, in a condition to annoy those who passed in its vicinity. The committee observed a small cess-pool near this point, but it appeared not to have been recently used as a receptacle at the time of their investigation.

The vaults of the old privies, which had both been removed when the committee made their inspection, were represented to them as having been shallow, and filled nearly to the surface of the ground with semi-fluid materials, as they were the receptacle of the slops from the chambers.

One of them was once cleaned out at night, in the course of the hot season of last summer.

The testimony as to the necessity of closing windows against offensive odors comes to us from sources hundreds of miles apart, in letters, in oral statements from living witnesses, and, as reported by their friends, from the lips of those who will speak no more.

This was stated, not of one room only, but of several, and of rooms in both buildings; and not alone of the windows of the dormitories, and in the night, but of some of the recitation-rooms, and in the day-time.

Not without interest in connection with this subject is the ascertained fact concerning the occupants of the southeast corner room in each story of the west building, the rooms most directly connected with such sources of contamination. The lower room was occupied by three, all of whom were dangerously sick, and one died. The two who occupied the corresponding room of the second story had a severe and protracted fever, while the teacher and her sister, who occupied the room in the third story, directly over these, both died. Indeed, a fact which has not yet been alluded to, but which must be stated in order to give a complete view of the case, seemed to indicate that the morbid influence was not entirely confined to the grounds of Maplewood. In a well-appointed dwelling, directly west of the premises, on the opposite side of the public street, two cases of typhoid fever occurred, and several other members of the family suffered from other forms of ill-health, accompanied by decided derangement of the stomach and bowels, and some of the members of a family in an adjoining house were reported to have suffered from some similar form of disease.

Whatever theoretical view of the subject be taken, the conclusion is the same, that the local sanitary conditions of the place must be mainly held responsible for this painful calamity.

To whatever extent the ignorance of sanitary laws may shield the violator from moral responsibility, it will not abate the physical penalty of such violation. This will fall with the same force upon the unconscious, the ignorant, the helpless, and the morally innocent, as upon the intelligent, the powerful, and the wicked. It is too much the custom to attribute all cases of sickness and death, however palpably the result of violated laws, to a special mysterious Providence, or to the decrees of fate, forgetting that without a miracle all natural events are the results of natural causes, and that over such causes men have no control. Though there is a Providence over all, it should be remembered that, in the world of nature, that Providence operates in accordance with, and by the means of, established laws. Though the hairs of our heads are all numbered, and not a sparrow falls to the ground without our Father's notice, yet the number of our hairs is determined by the fixed principles of our organization, and every sparrow which falls to the ground does so in accordance with laws established at the dawn of creation.

To prevent the poison of typhoid fever, when taken into the system, from producing its legitimate effects, except by natural agencies, would require as positive a miracle as to restore a severed head or arrest the course of the heavenly bodies in their spheres.

Instead of closing our eyes and soothing our minds by casting the responsibility of a great calamity upon Providence, we should look to the physical conditions producing it, and see whether those conditions are removable, or whether the consequences, by human foresight and agency, could have been prevented. Until this is done more generally and more effectually than heretofore, such calamities will continue to occur.

This report has been thus fully quoted from for the reason that it sets forth with the most convincing force the dangers to which all mismanagement of organic filth subjects us. It is true that few private houses—even when in the immediate neighborhood of barn-yards, pig-sties, and common privy-vaults—are subject to such a combination of evils as existed at Maplewood, but the difference is one of degree, not of kind, and in proportion as the causes exist, in just that proportion must their effects be feared. Dr. Carpenter, a high authority in sanitary matters in England, says:

The following case may be added in proof of the potency of an atmosphere charged with putrescent emanations in rendering the system liable to the attacks of zymotic diseases of various kinds.

A manufactory of artificial manure formerly existed immediately opposite Christ Church workhouse, Spitalfields, which building was occupied by about four hundred children, with a few adult persons. Whenever the works were actively carried on, particularly when the wind blew in the direction of the house, there were produced numerous cases of fever of an intractable and typhoid character; a typhoid tendency was also observed in measles, small-pox, and other infantile diseases, and for some time there prevailed a most unmanageable and fatal form of apthæ of the mouth, ending in gangrene. Many deaths occurred.

The proprietor of the manufactory was compelled to close his establishment, and the children returned to their ordinary health.

Five months afterward, the works were recommenced. In a day or two subsequently, the wind blowing from the manufactory, a most powerful stench pervaded the building. The night following, forty-five of the boys, whose dormitories directly faced the manufactory, were again suddenly seized with diarrhea; while the girls, whose dormitories were in a more distant part, and faced in a different direction, escaped.

The manufactory having been again suppressed, there was no subsequent return of diarrhea.

Dr. Williams, author of Principles of Medicine, speaking of the sources of filth and foul air, says:

The soil which drains from habitations contains, in addition to excrement, dirty water, the washings and remnants of animal and vegetable matter used as food, and other offal. All these are mixed together and stagnant in the corrupting slough that is retained in cess-pools and privies or that is carried into sewers. Every ill-drained house has a Pandora's box, ready to pour forth its evils when occasion offers, and always oozing them out in degrees sufficient for the impairment of health.

These materials continually poison both air and water; and typhoid fever, diarrhea, cholera, dysentery, dyspepsia, inappetency, general weakness, and mal-nutrition are the results of their pestiferous operation, acting in different degrees.

Dr. Stramm, of Berlin, in advocating sanitary reform as a sure means of annihilating nearly all epidemic diseases, says: "Before erecting statues, building museums, and buying expensive pictures, towns should be relieved of bad odors and fermenting putrescence;" and adds, that "good privies are far higher signs of civilization than grand palacies and museums of art."

The medical officer of health of the city of Dublin says:

Typhoid fever is about the most preventible of diseases, yet of this affection one hundred and forty thousand cases occur, and at least twenty thousand young persons including many of the flower of the people, die every year in England.

The name "night-soil fever" has been given to typhoid fever, so directly has night-soil (imperfectly kept) been proven to be the cause of this disease. Evidences might be indefinitely adduced to prove the connection between foul emanations from decaying organic filth and many of the most depressing and most fatal of the epidemic diseases. Among

these may be cited the National Hotel disease in Washington, at the time of the inauguration of President Buchanan, in 1857, which was occasioned by the obstruction of a privy-drain; and the death of Prince Albert, from typhoid fever, caused by gases escaping from a break in the sewer of Windsor Castle, directly under his library floor. The recent severe attack of typhoid fever, which so nearly proved fatal to his son, the Prince of Wales, was caused by a defect in a water-closet in an English country house at which he was visiting.

The matters of which we are treating exert their injurious effects, not only by means of foul gases arising from their putrefaction, but equally, in certain cases, by the infiltration of their liquids through a porous soil into drinking-water wells and springs. It is a singular fact that water thus contaminated is often peculiarly clear, sparkling, and pleasant to the taste, showing that the insidious poison of fecal matters is unaffected by passing through a soil that retains all perceptible foulness.

At Williamstown, Massachusetts, there occurred, in 1860, an epidemic of which the following account is given in the Maplewood report:

About the middle of June, 1860, typhoid fever broke out in a boarding-house. The whole number sitting at the table was from thirty to thirty-five persons, mostly students of Williams College. In the course of two weeks the greater portion of these boarders were affected, twenty or more of the students falling sick.

Dr. S. Duncan, one of the physicians who attended the cases, and made the investigation, says, in his communication:

On the 18th of June, 1860, I was called to visit, professionally, one of the boarders, and found him suffering with the initiatory symptoms of typhoid fever. At this time there was, to my knowledge, but one case of fever in town. The patient was removed from his lodgings in the college to this boarding-house, for the sake of greater convenience in care and treatment, and continued to use the water from the well on the premises for at least ten days from the first visit.

This patient was under treatment for about six weeks; and though having, at times, unfavorable symptoms, he at length recovered. About the last of June the cases began to multiply rapidly among the boarders; and, as the disease had not made its appearance in the town, the conviction was forced upon my own mind that its origin was local and that a solution of the problem might be found by an examination of the premises. The building, cooking-apparatus, and, in fact, the whole house, was minutely inspected, without discovering any cause for the sudden development of the disease; but out of doors was found what was thought at the time to be a satisfactory explanation of the phenomena.

A drain, which received all the refuse of the house, was found to be choked near its exit into another drain, which conveyed surface-water from a highly-cultivated field, and which also ran near the well. The season was uncommonly wet, and the earth in the immediate neighborhood of the well was so completely saturated with organic matter that it oozed through the ground and stood in pools of putrescence on the surface. Nearly two-thirds of the inmates sickened; and, though the cases differed in severity and duration, yet all presented the unmistakable phenomena of typhoid fever. There were no deaths. Among the boarders were a number who did not drink the water at dinner, and of these it was remarked that not one sickened! The family of one of the professors of the college, living in an adjoining house and using water from this well, sickened like the others; the professor, who drank no water at dinner, alone escaped. I am tolerably familiar with typhoid fever, and have never had a doubt that the disease appearing at that house, and which was associated with drinking that water, was typhoid fever. All that drank the water, unboiled, had the disease; all who avoided it in this state escaped. It appeared that the action of heat rendered the water innocuous, either by volatilizing, coagulating, or otherwise changing the organic matter.

Though several of the students, after becoming ill, went to their homes and suffered there sickness, no case is mentioned of the disease having spread from them to others. One of the other gentlemen, in his communication, says: "We thought the illness was from the water: 1st. Because of the drain so emptying that the foul water ran directly into the well from which we drank. 2d. Because, of some thirty or thirty-five boarders, all at the same table, those who drank tea and coffee, exclusively, three times a day, (and there were several such,) escaped all symptoms, as well as those who took ale for dinner, and tea and coffee at the morning and evening meals. 3d. It could not have arisen from impure air, study, or epidemic influence, as none in the town were

affected, save parties who used the water; and many who were sick were among the laziest students. 4th. Those were the subjects of the severest sickness who were, exclusively, drinkers of water. One of the sick, who never used any other drink, was confined eight weeks, and was unable to fill his appointment on commencement-day.

"Another, who drank water moderately, and only at dinner, had the disease in a much milder form, and was confined a very much shorter time."

This gentleman, the writer of the account, was seized on the 25th of June, and he says: "At or within a day or two previous to and after my illness, several of the boarders were seized with similar symptoms and sent home."

From these data it appears that the cases continued to occur from near the time of the attack of the first, until all were affected. Some resisted the influence of the water longer than others, but all were taken within a period of ten days. The water, when carefully noticed, was found to taste and smell of the sewerage, though when served upon the table with ice these qualities were not perceived.

Dr. Buchanan, in the appendix to twelfth report of the medical officer of the privy council, (British,) publishes the result of an investigation of an outbreak of typhoid fever in the village of Wicken Bonant, among persons who drank water from a well into which the drainage of a privy found its way through a gravelly soil. In this paper he says:

Of the forty-five cases, five have occurred among the one hundred and eighteen people who get their water from private wells. Two of these five, however, had been lodging in houses supplied by the public well, and two others of the five are, at the time of visit, of new occurrence, and their nature is still somewhat uncertain. Thus only one positive case occurred in five months among the one hundred and eighteen persons who drank water from private wells. The remaining forty (or, adding two of the above patients, forty-two) cases occurred among eighty-eight persons who had no source of water-supply except the parish well, some of them, however, occasionally taking water, when it could be had, from the brook. There were thus, among persons getting water from private wells, less than 3 per cent. attacked by fever; among persons getting water from the parish well over 46 per cent. were attacked. No other general difference, except the source of water-supply, can be observed between the families which suffered and those which did not suffer from the fever.

The measures that appear necessary for the permanent improvement of the village, and for putting it in a condition in which such epidemics as the present should be impossible, are essentially the supply of pure water and the safe disposal of all excrement. In view of the experience which I have gained in another inquiry, as to the operation of earth-closets, I venture to affirm that the adoption is, for Wicken Bonant, by far the most available way of compassing the latter of these ends.

Professor S. W. Johnson, of Yale College, in an article on the earth-closet system, says:

Most often it is our drinking-water that brings into us the contamination. New Haven is built upon a gravel plain, and the open soil gives free passage to the liquids that fall upon it. In multitudes of cases the well is but a few yards or feet from a cess-pool, that receives the kitchen slops on one hand and a privy-vault on the other. Earth has a remarkable power of absorption and disinfection, but this power chiefly resides in its fine and impalpable portions—in the clay, and not in the coarse particles of sand. A well, distant fifty feet horizontally from a privy-vault, both in a clayey soil, the writer knows, has yielded excellent drinking-water for thirty years, as attested by its taste, and by the fact that for that period no case of fever occurred on the premises. The writer knows another well, similarly situated, in New Haven, which furnished good water for about five years after it was excavated, in what was until then a vacant lot, but after this interval became unpleasant in taste, its flavor plainly suggesting the nature of its impurities.

In his researches on the cholera, in Bavaria, in 1854, Pettenkoffer traced its spread in several cases, in the most indubitable manner, to the use of water which had been in contact with the fæces of cholera patients.

The use of open vaults or water-closets emptying in cess-pools tends to fill up the soil with fecal matter. A single vault poisons a circumscribed space around it. External to this limit, the filth is destroyed by the action of the oxygen of the air, which is the great purifier. Within the limit named, the animal matters preponderate, either constantly or at some period of the year. They may long remain simply disagreeable, without being dangerous, and may again, of a sudden, in a way whose details have as yet escaped investigation, become the seed-bed or the nursery of the infection that breaks out in fevers and dysentery. The danger increases as the quantity of filth and the number of its receptacles increase. To cover them up does not necessarily remove the evil. The putrid matters soak into the soil and move upward and downward in it

with the motion of the soil-water. When we have copious rains they are carried down, perhaps, to nearly the level of the water in our wells. In the heat and drought of August these matters rise again. In the absence of rain, the rapid drying of the surface creates an upward capillary flow of the ground-water. The matters which in rainy times follow the surface-water to the depths in drought follow the ground-water to the surface.

A most striking instance in point is the following, taken from one of the British Blue Books:

Richmond Terrace, Clifton, England, is a crescent composed of thirty-four houses. In 1847, the inhabitants of thirteen of these houses drew their drinking-water from a well at the end of the crescent. The remaining houses were supplied with water from another source. At the end of September, the water of the well gave evidence to the taste and smell of being tainted with sewerage. *Early in October typhoid fever broke out, nearly at once, in all the thirteen houses in which the tainted water had been drunk, but did not make its appearance in any of the other houses.* In almost every one of the thirteen houses two or three persons were ill, and in some a much larger number. The houses in which the fever broke out were far apart in the terrace, and there was little or no intercourse between their inmates, the water from the well being the sole connecting link.

A similar influence has been discovered in the dissemination of cholera. Dr. Anstie, in his Notes on Epidemics, cites the following remarkable case:

The year 1854 was made memorable in the annals of medical science by the remarkable outbreak of cholera in the parish of St. James, Westminster. The disease had already announced its presence by the occurrence of a few cases during the latter months of 1853, but the number of attacks declined, in the first two quarters of 1854, to a very low ebb; at the end of June, however, they began to increase, till, in the last week of September, the cholera mortality reached 2,050. In the parish of St. James, the first fatal case for 1854 happened at the end of July; but there was only a dropping fire, as it were, which kept within quite moderate limits up to the last days of August, when suddenly the disease made an enormous explosion in the district. In the most crowded part of this densely crowded parish, there occurred, on the 31st of August, no less than *thirty-one* fatal cases, all within an extremely narrow area; on the following day, there were 131 fatal cases in the same area; on the 2d September, 125; on the 3d, 50; on the 4th, 52; on the 5th, 26; on the 6th, 28; on the 7th 22; on the 8th, 14 fatal attacks, all in the same space, which might be marked off by a circle whose radius would be of the length of 210 yards.

Fixing his attention on the local peculiarities of the district, Dr. Snow quickly perceived that one remarkable circumstance was common to the history of the large majority of attacks of the disease, namely, that the sufferers had been in the habit of drinking the water of a well in Broad street, which had a great reputation for sweetness and freshness. Analysis of this water soon showed that it was highly charged with organic impurities; and, on the 8th of September, the vestry, on the urgent persuasion of Dr. Snow, removed the handle of the pump and so prevented the further use of the well. On subsequent examination, it was discovered that the sewage from a neighboring house-drain had leaked into the well, and that the discharges of a patient residing in the house in question, and suffering from severe diarrhea, if not from actual cholera, must have mingled with the sewage immediately before the date of the great epidemic outbreak.

Dr. Anstie further says:

It is now well established that this affection (epidemic diarrhea) is caused by the effluvia from the decomposition of organic matter or by the admixture of such impurities with drinking-water. The diseases of which we have been treating certainly owe their propagation chiefly to sewer-gases in the air and sewage matters mixed with food or drink.

It would too far extend the limits of this article to go more fully into the question of the effect of putrescent organic matters on the health of those who are subjected to their influences, but the evidence is clear that typhoid fever is caused *only* in this way, and that cholera, diarrhea, dysentery and some other fatal diseases are much more active in the presence of such influences. Also that these matters produce their effect both by the escape of their gases into the atmosphere, and by the descent of their soluble parts into the soil.

THE QUESTION OF ECONOMY.

We are the products of the soil on which we live, and all our prosperity depends, directly or indirectly, on our ability to make use of its productive power. More than this, so far as we can trace our prosperity to the agricultural productions of the soil, it will be more or less in direct proportion to the soil's fertility.

If the history of the world teaches anything it is that individuals and nations prosper or decline in proportion as the soil is rich or poor; and that (at least in northern countries) civilization progresses as agriculture thrives, and recedes as the fertility of the soil becomes less. Any cause that should stop the production of food would, of course, put a stop to all human life, and any cause that should materially lessen it would speedily end all accumulation of the results of labor, and compel all who are able to live under the new conditions to the one task of securing food and clothing. That which we call our wealth—houses, highways, and all other products of civilization—represents, in the main, the excess of the products of the soil beyond the need for food of those by whose labor they are produced. This excess is exchanged for that which the farm cannot produce, and supports others, who are thereby enabled to apply their labor to other industries. Without at all undervaluing the work of those who do not cultivate the soil, and without attaching undue importance to the farmer class as constituent elements of society, it must be clear to all who give the subject the least consideration that, in the long run, no economy can be of much value that is not accompanied by a careful preservation of the producing capacity of the soil.

It may be taken as a self-evident proposition, that national prosperity depends on the fertility of the soil and on the health and vigor of the people, and that these depend on the economy of manures and on the absence of putrefying organic matters from the vicinity of dwellings. It is hardly necessary to bring forward arguments in support of these propositions; but it is very essential that the public should be made to realize their importance, and especially to appreciate the universal bearing of one of the most important items of the science of political economy, namely: "Mony littles mak a muckle." The manure that is wasted through the indifference of a single individual may seem to him too trifling to be worth the trouble it would cost him to save it. The wastes even of an ordinary household, as we have not been accustomed to consider their value, we let go without regard to consequences. The indifference of individuals and families makes up the indifference of communities. Communities make the states, and the states make the nation. The little drops of extravagance that trickle from every dwelling unite to form a flood whose aggregate is enough to appal all who realize its force.

Agricultural writers are tireless (and tiresome) in urging that greater care be given to farm-yard manure. It must not be piled in heaps under cover without being watered, lest much of its virtue be burned out. It must not be left under the eaves of the barn, lest its soluble parts be leached out by the rains. It must not be kicked about in the barn-yard, because every rain washes it away and every wind dries it away. There is no possible form for the warning, that farm-yard manure must be zealously cared for, that is not given over and over again; but it is not given once too often nor one whit too strenuously. Our only complaint is that the very men to whom we are indebted for so much really sound agricultural advice and instruction

are at least lukewarm in urging the careful preservation and application of this other class of fertilizers by the people at large. This indifference comes from long habit. In this country, at least, and in the countries from which our immediate ancestors came, other sources of manure have hitherto been sufficient for the purposes of a profitable agriculture, and a certain presumed delicacy has helped to prevent the discussion of the subject. The fact that in China such matters are preserved with the most zealous care has long been the subject for a sort of joke among persons otherwise intelligent.

The real interest in the subject being confined thus far chiefly to those who give a secondary importance to agricultural questions, the development of this refuse as a source of general fertility has been of insignificant importance, and we seem, as a nation, to be almost as far as ever from a rational solution of the question. Here and there, it is true, the all-conquering desire to gain has accomplished what, to reasonable minds, must seem a step in advance.

It is plain, nevertheless, to all who have given the subject the consideration it deserves, that the indirect efforts of town authorities and of individual farmers are of but feeble effect in the desired direction.

What is the value of the fertilizing matter that is lost by reason of a neglect of the item of economy, which we are considering, it is impossible to determine with positive accuracy; but the following computation, made by the present writer some years since,* may be taken as a moderate estimate:

The average population of the city of New York, including its temporary visitors, is probably not less than 1,000,000. This population consumes food equivalent to at least 30,000,000 bushels of corn in a year. Excepting the small proportion that is stored up in the bodies of the growing young, which is fully offset by that contained in the bodies of the dead, the constituents of the food are returned to the air by the lungs and skin or are voided as excrement. That which goes to the air was originally taken from the air by vegetation, and will be so taken again. Here is no waste. The excrement contains all that was furnished by the mineral elements of the soil on which the food was produced. This all passes into the sewers and is washed into the sea. Its loss to the present generation is complete.

In the present half-developed condition of the world there is no help for this. The first duty in all towns is to remove from the vicinity of habitations all matters which, by their decomposition, would tend to produce disease. The question of health is, of course, of the first importance, and that of economy must follow it; but it should follow closely, and perfect civilization must await its solution.

Thirty million bushels of corn contain, among other minerals, nearly seven thousand tons of phosphoric acid, and this amount is annually lost in the wasted night-soil of New York City.

Other mineral constituents of food—important ones, too—are washed away in even greater quantities through the same channels; but this element is the best for illustration, because its effect in manure is the most striking, even so small a dressing as twenty pounds per acre producing a marked effect on all cereal crops. Ammonia, too, which is so important that it is usual in England to estimate the value of manure in exact proportion to its supply of this element, is largely yielded by human excrement.

Practically the human excrement of the whole country is nearly all so disposed of as to be lost to the soil. The present population of the United States is not far from 35,000,000. On the basis of the above calculation their annual food contains over 200,000 tons of phosphoric acid, being about the amount contained in 900,000 tons of bones, which, at the price of the best flour of bone, (for manure,) would be worth over $50,000,000. It would be a moderate estimate to say that the other constituents of food found in night-soil are of at least equal value with the other constituents of the bone, and to assume $50,000,000 as the money value of the wasted night-soil of the United States.

In another view the importance of this waste cannot be estimated in money. Money values apply rather to the products of labor and to the exchange of these products. The waste of fertilizing matters reaches further than the destruction or exchange of products; it lessens the ability to produce. If mill-streams were failing year by year,

* An article on Sewers and Earth-Closets, published in the American Agricultural Annual of 1868.

and streams were yearly losing force, and the ability of men to labor were yearly growing less, the doom of our prosperity would not be more plainly written than if the slow but certain impoverishment of our soil were sure to continue.

Fortunately it will not continue always. So long as there are virgin soils this side of the Pacific, which our people can ravage at will, thoughtless earth-robbers will move West and "till" them. But the good time is coming, when (as now in China and in Japan) men must accept the fact that the soil is not a warehouse to be plundered—only a factory to be worked. Then they will save their raw material instead of wasting it; and, aided by nature's wonderful loom, will weave over and over again the fabric by which we live and prosper. Men will build up as fast as men destroy, old matters will be reproduced in new forms, and, as the decaying forest feeds the growing woods, so will all consumed food yield food again.

Professor Johnson says that formerly in Flanders the annual wastes of domestic life were valued at $9 (gold) for each person. It is hardly possible that, with the general advance in prices, their present value should not be much more than this. From a considerable experience in the use of manure, including night-soil, I am confident that the total wastes of each individual, including his proportion of the slops thrown from the kitchen, &c., cannot be justly estimated (at least in the more Eastern States) at less than $10. Whether this estimate would apply over the whole country may fairly be questioned, but one-half of the amount, or $5 per head, would bring the amount wasted by the whole population of the country to a sum that would more than pay the interest on the national debt.

There is another view of the case, which is also suggested in the foregoing question, that has an importance not to be expressed in dollars and cents. The fertility of the soil depends on constituents which it contains in very small proportion. These constituents enter into the composition of the crops produced, and at harvest they are removed from the soil. A very fertile soil may withstand this removal for many years, but, sooner or later, even the most fertile soil in the world (unless it is enriched by alluvial deposit) must show the effect of this constant subtraction. Probably as rich a soil as the world has ever offered was that of our western prairies, where it was believed, twenty years ago, that the fertility would be perpetual. To-day it is stated by the agricultural writers of that region, that "*the manure question is, after all, the great question at the West as well as at the East.*"

In the monthly report of the Department of Agriculture for October, 1867, the editor, in an article headed "Wheat Culture Ruinous," says:

Is proof of impoverishment wanted? One witness only is needed—the soil itself First, thirty bushels per acre is the boast of the farmer; then the yield drops to twenty-five, to twenty, to fifteen, and finally to ten and eight. Minnesota claimed twenty-two bushels' average a few years ago, (some enthusiastic friends made it twenty-seven,) but she will scarcely average this year twelve, and will never again make twenty-two under her present mode of farming. To be sure, there are excuses. The seasons do not suit, as formerly. Blight or rust comes, or the fly invades; but all these things are evidences of exhaustion, and prey upon the soil in proportion to its deterioration. * * * * * * The average yield of wheat in England is stated at twenty-eight bushels per acre, never less than twenty-six, unless in a year of unusually bad harvests. The average in this country is less than half of the lowest of these figures. Why is it? Certainly not because our soil is naturally poorer than theirs, neither because our climate is so much worse for wheat culture. It is mainly for want of a suitable rotation of crops, of a more careful husbanding of resources of fertilization, of a more thorough and careful culture.

This waning fertility has an importance that cannot be measured with money. It portends, if it is allowed to go on, a lessened ability, first, to produce, for the support of other classes, a surplus over the needs of the farmer, and then to support the farmer himself. In other words, it threatens a condition in which money will have no further value. Of course no people like our own will allow the impoverishment of the soil

to reach such a point; but it would be impossible to compute the amount of the injury that must result, even from so much impoverishment as will make the yearly application of manure necessary to the production of paying crops on lands that are now fertile with only occasional application. As man is more richly fed than the lower animals, so his feces are the most valuable as manure. This is the only standard by which the question of value can be decided. The feces are simply the refuse of food which has been taken into the system, and they contain only the manurial constituents of that food, less the very little that the body loses or uses in another way. As a rule, this is but little more, in a whole lifetime, than is embraced in the hair that has been grown, the young that have been produced, (and, in the case of suckling animals, the milk that has gone to feed other bodies,) and the weight of the body at death. All the rest—probably *ninety-nine per cent.* of the food—is represented, so far as regards matter taken from the soil, in the manure that is voided. The quantity and quality of the manure is in direct relation to the quantity and quality of the food.

Not only does human manure contain the most that is of value, but, under our usual system, it is the one that is the most universally wasted. Even on soils that are but slightly deteriorated the dung of domestic animals is sought after and used for manure, but not until a long time after this—only when the use of manure is absolutely necessary to any successful farming—do we find that night-soil is considerably used.

It is not worth while to discuss here the reasons for this neglect; it is enough that we recognize its existence. *It would be safe to say, that there is not a county of New England in which one-tenth of the human feces is used in agriculture.* The farther we go from the Atlantic coast the more does this neglect prevail, until we reach a point where the subject is considered almost too indelicate even for the ears of men, and where absolute waste and the extreme of discomfort and (*sans rancune*) of nastiness reign supreme. A very good estimate of the value of night-soil may be gathered from the following statement, which has been condensed from a German work on the Employment of Human Excreta and Animal Offal in Agriculture.*

Inquiry has shown that a grown person produced daily 2 pounds of feces, of which $1\frac{1}{2}$ pounds are fluid and $\frac{1}{2}$ pound solid. According to Berzelius, the fluid feces, contained in 100 pounds, water, $93\frac{1}{3}$ pounds; urea, 3 pounds; uric acid, $\frac{1}{10}$ pound; organic matter, $1\frac{3}{4}$ pounds; slime, $\frac{1}{30}$ pound; sulphate of potash, $\frac{1}{3}$ pound; sulphate of soda, $\frac{1}{3}$ pound; phosphate of soda, $\frac{1}{4}$ pound; acid phosphate of ammonia, $\frac{1}{6}$ pound; muriate of soda, $\frac{2}{5}$ pound; muriate of ammonia, $\frac{1}{6}$ pound; phosphate of talc and lime, $\frac{1}{10}$ pound; silicic acid, $\frac{1}{300}$ pound. The most important of these substances is the urea, a product of the body which does not vary with the kind of food that may be consumed, and which therefore does not consist of those portions of food that have become useless for purposes of sustaining life. It is composed of inorganic matter, and 100 pounds contain $20\frac{1}{4}$ pounds carbon, $6\frac{1}{2}$ pounds hydrogen, $46\frac{3}{4}$ pounds nitrogen, $26\frac{1}{2}$ pounds oxygen; so that nearly one-half is nitrogen, which, if not collected, soon forms carbonate of ammonia, and evaporates.

In every 100 pounds of urine there are $4\frac{5}{6}$ pounds nitrogenous matter in the proportion of 100 to $46\frac{3}{4}$, so that in 100 pounds of urine we have about $2\frac{1}{4}$ pounds of nitrogen.

In 100 pounds of solid feces we have $4\frac{1}{10}$ pounds nitrogen; so that in

* Die Benutzung der menschlichen Ausscheidungen und der thierischen Abfälle, von Wilhelm Hahn.

the yearly product of a grown person (547 pounds fluid and 183 pounds solid feces) we have in the fluid 12½ pounds nitrogen, in the solid 7½ pounds nitrogen, or 20 pounds nitrogen per annum, or in 100 pounds of the mixed feces we have 2¾ pounds nitrogen. Now, according to Boussingault and others, the mixed feces of the horse contain of nitrogen 0.65 per cent., or ⅗ pound; neat cattle, 0.36, or ⅓ pound; pig, 0.61, or ⅗ pounds; sheep, 0.91, or $\frac{9}{10}$ pound; so that, in respect to nitrogen, the feces of man produced in one year are equal to 27 cwt. 8 pounds horse-dung; 50 cwt. cattle-dung; 29 cwt. 60 pounds pig-dung; 19 cwt. 89 pounds sheep-dung; or 100 pounds mixed human feces are equal to 417 pounds horse-dung; 753⅓ pounds of cattle-dung; 445⅕ pounds pig-dung; 298½ pounds sheep-dung.

As compared with the best guano, which contains 13 per cent. of nitrogen, the yearly product of a grown person would equal 1½ cwt. of the latter as regards nitrogen, or 100 pounds of mixed feces would equal 34½ pounds of best guano.

As the alkalies and phosphates are of the greatest importance when testing the value of manures, it is necessary in comparing the human feces with those of animals to find out the relative proportions of these substances.

Experiments show that the mixed feces of a grown person in one year are equal as regards the alkalies to 7 cwt. horse-dung; 7 cwt. 16 pounds cow-dung; 7 cwt. 27 pounds pig-dung; 3 cwt. 70 pounds sheep-dung; or 100 pounds human feces equal to 109 pounds horse-dung; 111 pounds cow-dung; 112 pounds pig-dung; 51 pounds sheep-dung.

In respect to phosphoric acid, the year's product of human feces equals 13 cwt. 47 pounds horse-dung; 26 cwt. 94 pounds cow-dung; 13 cwt. 47 pounds pig-dung; 8 cwt. 93 pounds sheep-dung; or 100 pounds human feces equal 208 pounds horse-dung; 415 pounds cow-dung; 208 pounds pig-dung; 124 pounds sheep-dung.

In comparing human feces with those of animals, it would be well to take into consideration the fact that quantities of straw, &c., are mixed with the latter. A comparison of human feces with stable-manure will show that 100 pounds of the former are equal in respect to nitrogen to 550 pounds horse-manure; 753 pounds cow-manure; 560 pounds pig-manure; 400 pounds sheep-manure. In respect to alkalies, to 135 pounds horse-manure; 140 pounds cow-manure; 142 pounds pig-manure; 75 pounds sheep-manure. In respect to phosphoric acid, to 320 pounds horse-manure; 500 pounds cow-manure; 330 pounds pig-manure; 250 pounds sheep-manure.

As the best guano contains about 12 per cent. alkali salts and an equal quantity of phosphoric acid, 100 pounds mixed feces will equal 8 pounds guano in respect to alkalies and 5⅔ pounds in respect to phosphoric acid.

Surely further evidence is not needed to show that if there is one question of national economy which is paramount to all others, it is that which relates to the saving of human manure and its use in agriculture. This and the question of health being assumed to merit the important position here assigned them, we will now consider the means by which the desired ends can be most advantageously secured.

MR. MOULE'S DISCOVERY.

The practical application of the disinfecting power of earth, by the aid of a mechanical contrivance to simplify its application, is due to the Rev. Henry Moule, the vicar of Fordington, Dorsetshire, England.

While the disinfecting power of the soil has been known since the time of Moses, the superiority of *dry* earth for this purpose seems to have been a new discovery, and Mr. Moule has devoted himself in the most enthusiastic and faithful manner to the propagation of the knowledge of his discovery. He has also devised an apparatus for the practical application of his system, that is so simple, so cheap, and so effective as to place its advantages within the reach of even the most economical household.

Those who have known nothing of the use of the earth in this way will perhaps be surprised to be told, that such an application of Moule's system as may be easily made by any household in town or country, will secure to all an absolute immunity from the danger to health set forth above as incident to other systems, and an absolute saving of all the manure that is now wasted under the present neglectful system.

The portable form of the earth-closet is adapted for use in any bedroom, dressing-room, or closet; and the stationary closet, which requires less frequent attention, may be set up in any unused room in the house, or in an addition erected for the purpose at any convenient point. It is best in all cases (as with the water-closets) to give a slight ventilation to the apartment in which either the movable or stationary closet is placed, but this is not absolutely necessary, as, with a little extra care, and by using the earth a little more freely, every suspicion of odor may be prevented.

For those who wish to avoid even the slight expense of introducing the mechanical apparatus, it will be quite sufficient to have a box of sifted dry earth, with a tin scoop or cup, with which to throw down the requisite quantity of earth after each operation. For use in the sick-room, where an earth commode cannot be obtained, it will suffice to have a few paper bags containing about a pint of earth each, with which immediately to cover the defecation.

Precisely what is the *modus operandi* of this disinfection by the use of dry earth is not yet known, but almost any finely-powdered material, even a fine soil that consists almost entirely of sand, answers the purpose. Nothing is better than sifted anthracite coal-ashes. The ashes of bituminous coal are better for the purpose if mixed with a small quantity of dry earth. Considerable experience indicates that for farmers, and for all others who are so situated that they can command a supply of ordinary surface-soil, it will be best to use this in whole or in part. Ashes are as effective in saving the manure, but they are not so rich as ordinary soil in elements of fertility which the decomposition of feces in the mass will develop.

To show how practically effective this system is, it will suffice to describe its application in the writer's own house and grounds, where it has been in operation for more than a year, having been introduced after three years' experience of the system elsewhere. On the second floor, in a small closet built for the purpose, there is a seat supplied with the distributing apparatus, and having a reservoir holding about one barrel of the prepared material. Immediately under the seat there is a conical pot of galvanized iron, having a capacity of about one bushel. This is closed by a hinged bottom, held in its place by a counterpoise, and furnished with a device by which it may be opened at pleasure. This open bottom empties into a ten-inch galvanized iron pipe, which passes through the corner of a closet below and through the first floor. The pipe is concealed from view by a board casing. Immediately under it in the cellar, a brick reservoir, two feet and a half square in the clear, is built from the floor to the ceiling, with an opening about one foot

square in its side, by which its contents may be removed from time to time. This closet is used regularly by two persons, and occasionally by others. Its position renders it impossible to ventilate it in any way, yet it is as free from any offensive odor as any other part of the house. On the first floor of the house, in a closet under a staircase, there is another seat similarly arranged, the dumping-valve of which opens directly into a second brick receptacle in the cellar. This closet has a window which may be opened for ventilation, and is used by two other members of the family. In a closet opening off from one of the bedrooms there stands a "commode," or movable earth-closet, which is used exclusively by all guests occupying the apartment. The same commode has been used about one-half of the time for the past three years; for more than a year of the time it was used constantly and regularly by an average of three persons, yet there is not a chair or table in the house that is more free from objection as an article of furniture.

A small privy, opening from a laundry close to the kitchen-door, has its seat directly over a dry vault about two feet deep in the ground. It also is furnished with an earth-reservoir and a distributing apparatus. The chamber-slops and waste-water of the kitchen are disposed of as will hereafter be described.

For nearly a year past no other material has been used in any of these closets except the sifted ashes from the coal-fires, a kitchen range, and the furnace by which the house is heated. When the accumulations are taken from the receptacles in the cellar, they are thrown in a heap on the cellar floor and there remain until they are dry enough to be sifted for a second use, usually two or three weeks. About 5 per cent. of the mass consists of lumps of fæces incrusted with ashes; the remainder is ashes impregnated with such fæces as have been decomposed (nearly all) with the solid residuum of the urine and with the ammonia and other gaseous compounds that have resulted from the decomposition of the solid and liquid manure. The paper has nearly all been destroyed by the slow decomposition of the manure.

During the whole operation from the time when the feces are first covered in the vessel under the seat, including the whole time that they lie in the receptacle below, and in the heap where they are getting ready for the sifters, there is no more indication, either by their appearance or by their odor, that they contain any sort of impure matter, than there would be in a corresponding amount of freshly burned, pure ashes. The servants' closet, outside, is equally free from offensive odor or appearance. The whole arrangement is as nearly perfect as anything of the sort can be; less offensive than water-closets similarly placed (and receiving only the same amount of care) ever are, without the expense of plumbing, the great labor or cost of supplying water, the danger to health that the least imperfection in water-closets is sure to entail, the danger of injury from frosts, and the outrageous waste of fertilizing matter. The labor of attending to the three closets amounts to less than a half day's work per month, and the value of the manure is certainly not less than $50 per annum.

The ashes, instead of being a nuisance to be got rid of, are converted into a valuable manure, especially as they are passed twice and sometimes three times through the closet.

So much for the practical and tangible results. What may be called the sentimental advantages are no less striking, if we consider what it is worth to be exempt from the necessity of paddling through mud and slush and snow-banks, in the full light of day, to shiver in an exposed privy at the bottom of a garden, or to be suffocated by its foul summer

odors. In addition to all this, there is no longer a possibility that the drinking-water well will be poisoned by the leaching of the contents of a privy-vault into the water-seams by which it is supplied—a consideration that bears most strongly against the use of a water-closet discharging into a cess-pool in the grounds, as in the case of nearly all houses that are supplied with water but are not connected with public sewers.

The cost of these three closets cannot be exactly stated, but it did not exceed the cost of one good privy with two compartments, over a stoned vault, built as is usual in corresponding establishments. After an experience of four years in the use of Moule's earth-closet system, no consideration would induce me to exchange it for the most complete application of the water system that I have ever seen. If it were possible for me to state more strongly my appreciation of its advantages, I would gladly do so, for I believe that in no other way could so much real and lasting good be done to the people at large as by causing them to realize the benefits that lie so easily within their grasp. Prominence has been given to the above instance of experience with the earth-closet, because it is the one of which the writer can speak positively; but other evidence might be cited almost *ad infinitum* to prove that others have been equally well satisfied with their experiments. Yet the testimony is not universally favorable; for, like all other human devices, the system requires some care in its management. An earth-closet will not work satisfactorily unless it is supplied with dry earth or some other suitable material, nor will its contents be deodorized unless the machinery is operated and made to cover the deposits. All that is claimed is, that if it receives the very small amount of attention that any such device demands, it accomplishes its purpose as perfectly as could be desired. Among the important trials to which it has been subjected, none has been more severe than that at Fort Adams, where the experiments were made that led to its adoption by the War Department. The following extracts from the official reports to the Chief Engineer of the Army will show the success that has attended its use at this post:

While many minor improvements can undoubtedly be made, both in construction and management, it is the general opinion that the entire adaptability of the "dry-earth system" to Fort Adams, and any similar military work, is thoroughly demonstrated. I believe there can be no question of this, provided the closets receive the care and attention necessary to the successful operation of any process, however simple or complex.

The soundness of the general principles involved in the application of dry earth, as a means of disposal of human excreta, has been already so thoroughly demonstrated by many competent persons, under so many and varying circumstances, that it seems unnecessary to go into further discussion of the subject here. To avoid repetition, while concentrating the best information available, I have therefore attached to this report several pamphlets, sketches, &c., from various sources, all bearing uniform testimony to the entire efficiency of the system, as far as observed, and fully explaining the details of the various sorts of machinery employed; the best modes of preparing and applying the earth, and its effect upon the matter voided in the closets; the advantages of the earth system, of both closets and sewerage, as a sanitary measure, over any other known plan; and the value of the residuum from the closets as a fertilizer; together with much valuable information worthy of perusal, the truth of which is being more firmly established daily.

Now, no machinery of any sort, no matter how simple or how automatic, will work successfully unless properly cared for. From the beginning, these fixtures at Fort Adams have worked perfectly, with the exception of occasional difficulties easily remedied with a little care and thought. For instance, I was informed last March, by the soldier in charge of these closets, (one who has had charge of them, too, nearly ever since they were built,) that not one of the whole twenty sets worked properly; that the "chucker" that should throw the earth and cover the fecal discharge could not be made to turn over after rising from the seat, and that hence all the earth in the hopper above ran through the closets until the main earth-reservoir was entirely

exhausted, and that for this reason they were not putting earth in the reservoir at all, but were shoveling in what was necessary to cover the excreta through the trap-doors below, shown on Fig. 2. I found the sole difficulty was in the fact that the bearings of the iron-work needed oiling. It was done at once, and the closets worked as well as ever. Such difficulties would obtain in any machinery subject to rust, not kept properly lubricated.

Their efficiency depends upon the degree of care they receive. If the simple and well-defined rules for operating these fixtures are adhered to, there is no reason why they should not work perfectly.

It has been found that a mixture of coal-ashes and dry earth work quite as well as dry earth alone. For some time past this has been done at Fort Adams with good results, the ashes and earth being mixed in nearly equal parts.

In closing this report, I wish to add my testimony to the very efficient working of the earth system, as applied to Fort Adams, believing, as I do, that it is the best mode as yet devised to meet this want at a military post, when properly arranged and administered.

As to the principle of the earth-closet, it is the only one that can be applied in casemates, so far as I can judge, and I believe it is the best possible for all forts of a permanent character, as its facilities for cleanliness are unrivaled. It is better than a system of water-closets, simple, less expensive, less liable to get out of order, and, in my opinion, should be applied wherever it can be in the army.

This report is accompanied by the written opinions of all the principal officers of the post, which unanimously indorse the system as the only one that is applicable to such establishments as that at Fort Adams. It would be easy to multiply certificates of the value and practicability of this system from men in all stations of life in this country, but it is deemed sufficient, in addition to the above accounts of its success, (the trial at Fort Adams being probably more severe than it could possibly be subjected to under other circumstances,) to make a few extracts from the latest British official report on the subject.*

Dr. Buchanan, a high sanitary authority, was deputed to make a thorough investigation of the results of the trying experiments to which Mr. Moule's system had been for some years subjected in England, with a view to its adoption by the local sanitary authorities, for the cleansing especially of towns and villages. He goes very carefully over the whole system, and closes with the following:

Summary as to the advantage of the earth system.—My inquiry brings me the following results:

1. The earth-closet, intelligently managed, furnishes a means of disposing of excrement without nuisance, and apparently without detriment to health.
2. In communities the earth-closet system requires to be managed by the authorities of the place, and will pay at least the expenses of its management.
3. In the poorer class of houses, where supervision of any closet arrangements is indispensable, the adoption of the earth system offers special advantages.
4. The earth system of excrement removal does not supersede the necessity for an independent means of removing slops, rain-water, and soil-water.
5. The limits of application of the earth system in the future cannot be stated. In existing towns, favorably arranged for access to the closets, the system might at once be applied to populations of 10,000 persons.
6. As compared with the water-closet, the earth-closet has these advantages: It is cheaper in original cost; it requires less repair; it is not injured by frost; it is not damaged by improper substances being thrown into it; and it very greatly reduces the quantity of water required by each household.
7. As regards the application of excrement to the land, the advantages of the earth system are these: The whole agricultural value of the excrement is retained; the resulting manure is in a state in which it can be kept, carried about, and applied to the crops with facility; there is no need for restricting its use to any particular area, nor for using it at times when agriculturally it is worthless; and it can be applied with advantage to a great variety, if not all, crops and soils.

Dr. Buchanan thus states the principles and practice of the system:

As regards the principle of the earth-closet, the evidence as to the powers of dry earth is unequivocal. If about a pound and a half of suitable earth, carefully dried, be thrown

* The Twelfth Report of the Medical Officer of the Privy Council, (1870.)

over a dejection, all smell from it is forthwith removed, and if the same quantity be mixed with half a pint of urine, the latter is absorbed. The mixture of earth with stool and urine is not only inoffensive, when fresh, but remains so after keeping for two or three months, or longer.

The process which goes on in the mixture is obviously one of disintegration and of some combination between the earth and the organic matter, as is evidenced by the disappearance of stools, and even of paper, among the other constituents of the compost. But the absence of fetor from the mixture of earth with stool or urine, even with prolonged keeping, shows that decomposition in the ordinary sense does not take place.

The Rev. H. Moule, to whose observations the practical use of these facts is due, regards the process which takes place in the mixture as consisting in a change of the organic substances of excrement into the state in which organic matter naturally exists in fertile soil, in such a way that the animal refuse becomes proximately available for the support of the plant, without undergoing ultimate reduction into simple salts and gases.

I have next to mention a circumstance, of the truth of which I have complete evidence, both from the statements of those who have used the system, and also from my own observation, but which was at first unexpected and surprising to me. It is, that the mixture of excrement with earth, after being kept a while and then dried, has again the power which the original earth possessed of absorbing and making inoffensive any stools and urine to which it is applied. This power is so marked that it has been repeatedly alleged to me that the earth (especially if clay) acts better a second time than the first, and I can answer from my own observation, that earth used three and four times over, with drying it to the proper stages, will render excrement quite inoffensive. The limits of this power do not appear to have been reached, but for experiment's sake the earth has been employed a dozen and more times, when it must have come to have more than half its bulk of excrement, with the same result on the dejections as at first, but with the other result of getting a manure too strong for use by ordinary method.

This opinion has been abundantly verified in the writer's own experience, the same earth having been used seven times, without any apparent lessening of its deodorizing power; just as we find the strongest deodorizing power to be possessed by the soil of a garden which has been annually manured for many years. The offensive manure, on becoming decomposed, yields carbonaceous matter, which is one of the best of all absorbents.

Dr. Buchanan states the following concerning the earth-closet in public and other institutions:

At Lancaster the national schools of St. John and St. Thomas are wholly supplied with closets on the earth system, and those of the boys' national school attached to the parish church are also thus supplied. Earth is supplied to these closets by the agents of Mr. Garnett, the gentleman whose operations will be further described in considering the working of the system in the town of Lancaster. The earth is delivered to the closet-hoppers once a day only, by back apertures to which Mr. Garnett's men have access, and each dejection is covered as soon as passed. At St. John's school the arrangements answered perfectly well in every respect. Six closets, each of good construction, are here placed in a row, a wall separating three which are used by boys from the other three which are used by girls. The seats are all clean, and from no closet is there any smell or other offense.

The Dorset County school at Dorchester has eighty-three boys, and here earth-closets began to be substituted for water-closets at the end of 1865, the reasons for the change being similar to those at the Lancaster school. Here the whole of the day urine, (the night urine going with slop-water,) as well as the stools, is dealt with under the earth system. Four self-acting closets are arranged, two over each end of a water-tight vault, with the intermediate space formed into urinals. The vault is twelve feet long, six feet wide, and seven feet deep. Earth, artificially dried, is stored (a week's supply at a time) in the shed behind the closets, and from this store the hoppers of the closets are filled as often as required, and the urinals are supplied four times a day. About a ton a week is furnished, being at the rate of four pounds a boy daily, an amount rendered necessary by the plan of dealing with about two-thirds of the urine as well as with the stools.

Wimbledon Common, in England, is the annual camping-ground of the British volunteer forces, where large numbers of men pass a fortnight every summer, under canvas, circumstanced in all respects as they would be in a field campaign. Prior to the introduction of the

earth-closet into their encampment, no device had been found by which their latrines could be made even tolerably safe. They were not only a nuisance to the camp, but an offense to the neighborhood. The manner in which the earth system answered its purpose, even during the hottest weather that has been known in England during the century, will be understood from the following extracts from Dr. Buchanan's report:

The camp latrines consist of ten blocks, two of which are for particular use. Passing over the latter as not putting the system to the greatest test, it will be enough to give an account of the public latrines. These contain in all one hundred and fourteen closets and forty-six urinals. The largest block consists of fifty-six closets and sixteen urinals, the smallest of eight closets and two urinals, being placed in rows, back to back, with a passage (having a locked door) between the rows, and a shed for storing dry earth at both ends of the passage of the main block, and one end in the others; the whole is covered over and fenced in, in such a way as to allow very ample play of air through the structure. Every part of the block and of the structures of the closets and urinals is made of new pine boards, not painted or otherwise covered, fitted together in frames, so that the wood may be easily removed and used up for other purposes.

Underneath each row of closets and urinals is a pit, into which all stools and urine fall, and in which they are covered up with dry earth. These pits on either side of the central passage are some four and a half feet deep by five feet wide, are dug simply into the ground, and are calculated to suffice, without needing to be emptied, for the requirements of the fortnight during which the Wimbledon meeting lasts. Each closet is fixed with the company's self-acting apparatus, which, worked by the weight of the person on the seat, at once covers up with about one and a half pounds of dry earth all matters discharged when the closet is used. Each urinal is a recess, having a rail of galvanized iron in front, and a floor of the same material. The urinals are not furnished with self-acting apparatus. From the central passage the hoppers or service-boxes at the back of the closets are filled every morning with a supply of dry earth, and are refilled as often as required, and from hence also the ground below the urinals is strewed by hand labor with dry earth as often as is wanted, to keep the topmost layer of earth in the pit from looking damp. To each urinal about 180 pounds of earth are supplied each day.

On the whole, 120 tons of earth were dried and stored before the commencement of the meeting, and in case of need a few more tons were prepared as a reserve. At the end of the meeting it was found that 140 tons had been used. The earth which has this year been chosen by Messrs. Girdlestone for the purposes of the latrines, out of various kinds that are to be had within the camp, is a clay, which, being dug up in dry weather, readily crumbles, but is not fit for its special use without further drying. As the drying could not, for reasons of time, be done by the mere action of air, the earth has been prepared by being spread out in a shed over some iron plates below which a fire is lighted. The earth, thus treated, falls into a coarse powder, which suits the mechanism of the self-acting closets extremely well.

The number of persons making use of the public latrines cannot be accurately ascertained. The average number of persons living in camp and using these places (officers, volunteers, soldiers, administration, and servants) amounts to about 2,425, while the total number of visitors was 80,000 for the fifteen days, being, with volunteers, &c., an average daily attendance of about 7,758. It may be estimated that the public closets are used each day (say once) by an average of 3,000 persons, and that the public urinals, used by almost every male (resident or visitor) in the camp, are used upward of 10,000 times in the course of the average day. Taking five ounces as the average quantity of each micturition, there comes to be a total of nearly 1,000 pounds of solid and over 3,000 pints of fluid excrement dealt with in the public latrines of the camp in the average day.

Careful examination was made of the working of these arrangements, first on the sixth, and secondly on the eleventh day of the meeting. The results of the two visits were identical. Upon entering a latrine-shed, and getting into the recesses of it, where there was least room for currents of air, two or three varieties of odor might be found. The only one that was invariable was the smell of new wood. In other cases only a faint smell of fresh feces was observed, and it was then commonly found that some of the closets were in actual use. In a few instances a trace of urinous smell was noticed, apparently where the injunction not to urinate on the woodwork had been usually disregarded. In taking up handfuls of earth saturated with urine, and on smelling closely to it, a peculiar honey-like odor could be detected. There was absolutely no smell of decomposing feces or urine. Nothing could possibly be more satisfactory than these results. During the meeting it had been necessary to empty two of the earth-pits, and those engaged in this work agreed in stating that no offense had been produced in the process. Apparently the arrangements might, with the good supervision

that was given to them, have continued in equally satisfactory operation for an indefinite time; though probably, if they had been designed for permanent use, some non-porous material would have been chosen for the urinals, so that any wetness could be efficiently rectified by dried earth dredged over the wetted surface. As regards any effect which the earth system at Wimbledon may have had upon health, I have no hesitation in stating my belief in its wholly beneficial influence.

In forming an opinion on this point I have followed, as being the most trustworthy guide, the judgment of Surgeon Major Wyatt. This gentleman, the principal medical officer of the camp since 1865, has had large experience, under varied conditions, of the circumstances affecting the health of camps, and knows well how to estimate the value of the latrine arrangements used therein. He writes, in reference to the use of earth-closets at Wimbledon in 1868: "With the exception of two days, nothing could have been more satisfactory than the working of the earth-closets, although, on account of the unprecedented amount of diarrhea, they were in unusual demand."

Dr. Buchanan also reports concerning the earth system in a village:

At Halton, near Wendover, in Buckinghamshire, the closet arrangements are altogether on the earth system, as defined at the beginning of this report. The plan has been at work three and a half years. The smallness of the place gives a particular interest to the experiment here, as showing how the system meets the needs of villages, which have been almost always passed over by the engineering sanitarian, but seldom, for long together, by epidemics of enteric fever. The earth system is at work in all of the thirty-three houses at Halton, and in twenty-two of the houses of Aston Clinton, a neighboring village—in both places under the auspices of Mr. James, of Halton. It must be confessed, indeed, that the experiment has here been made under exceptionably favorable circumstances, for Baron Rothschild, the owner of the land, Mr. James, his agent, and the residents themselves, all perform perfectly their parts, to make the system a success; and, further, the villages are well supplied with water and sewerage, and each cottage has a piece of ground attached to it, handy for receiving any liquid refuse which has a value as manure.

The closets are all furnished with apparatus for the supply of earth to each dejection, the apparatus being generally contrived to act by the weight of the sitter. The closet structure is in all but two instances detached from the house, and has an opening at the back for the supply of earth and for the removal of manure from the pit. Many of the closet structures were newly built at the time the earth-closet was introduced.

The earth is a loamy garden mold, which is dug in the summer and stored in an open shed. However dry-looking, it is all artificially dried before being used. The storage-sheds and kiln are of very simple construction, and are used not only for fresh earth, but for the storage and drying of the material taken from the closets. Such material, after being dried, is in part again used in the closets, and the process is, to some extent, repeated a third time. Earth that has been through the closets once and twice is found to be completely inodorous. In answer to inquiries whether people who live close by the drying-shed are not offended by the drying of the manure, it is stated that the process does make some little smell, but that it is scarcely perceptible beyond the shed, and offends no one.

The earth, when dried and screened, is taken to the closets by wheelbarrow, and a bucketful is supplied to the hopper of each closet, twice or three times a week; about a hundred-weight a week being the average quantity furnished to each. Some closets, such as those at the village school, require to be supplied with earth oftener than this. The earth-pits are emptied every six months, in a few cases oftener.

On an unannounced visit to Halton, I saw the every-day working of these arrangements; visiting every closet in the village, I found only one which I suspected to have any trace of smell. The mechanism of every closet was in good order, and all of them were clean. Two closets were found under the same roof with the house, and the occupiers not liking them so placed, had only used them occasionally when there was sickness in the house. For ordinary use they had a garden privy, with cesspool, the only one left in the village; it was a typical old-fashioned privy, and gave the only decided stink met with throughout Halton. The drying and supply arrangements were found to work perfectly, regularly, and easily, one man's time being amply sufficient for the whole working of the system in Halton. Aston Clinton, being some two miles distant, the use of a horse and cart, with the services of a boy, is occasionally required. About 130 tons (of which about a third has not before been used) is the amount of earth passed yearly through the fifty-five closets of the two villages. No repairs have been required to the closets, beyond a nail here and there where the original carpentering was defective. No offensive smells have been observed on emptying the earth-pits. Fever and diarrhea have been wholly absent from the village since the new system has been in action; but so they had been absent before the system had been introduced.

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As regards the value of the closet product, Mr. James quotes to me the opinion of two

farmers holding land near Halton, an opinion at which they had arrived by actual trial independently of each other, that earth which had passed once through the Halton closets had a minimum agricultural value of £3 ($15) a ton.

To sum up the evidence on the subject, it is entirely reasonable to say, that for all of the purposes for which it is intended the earth-closet is a perfect machine. Its cheapness, its simplicity, and its adaptation for all conceivable circumstances, whether in town or country, make its general adoption morally certain. It will never displace the water-closet in cities which have an abundant public supply of water, until manure attains a value that will compensate householders for the slightly increased labor it necessitates; or until the danger to health of the ordinary water-closet is more generally understood than at present.

DESCRIPTION OF THE APPARATUS.

The simplest form in which the earth system can be applied is to have at hand a box of sifted dry earth, with a small scoop or tin cup with which to distribute it over the feces, or to keep the supply in small paper bags, each holding enough for a single operation, say a little more than a pint. This will afford a satisfactory means for testing without cost the efficiency of the application; but it will lead all who care for convenience and nicety to the subsequent adoption of the Rev. Mr. Moule's mechanical system, or its equivalent.

The apparatus which, in its most compact form, is shown in the commode, Fig. 1, contains in the back to the seat a vibrating hopper of galvanized iron, holding enough earth for from fifteen to twenty operations. In the box under the seat, to which a door opens at the front, there is a galvanized iron hod, shaped very much like a coal-hod. Under the hopper there is a device which at each use throws forward into the hod the requisite quantity of earth, and is worked either by the pulling of a handle at the side of the seat, ("pull up" variety,) or (in the "self-acting" variety) by the dropping of the weighted levers, when the person is raised from the hinged seat. A view of the skeleton machinery is shown in Fig. 2.

In privies and fixed closets precisely the same mechanical part, including the hopper, is used; but a larger reservoir, holding any desired quantity of earth, is built above the hopper, and a larger receptacle, sometimes even a vault in the ground, takes the place of the hod that is used in the commode. Sometimes there is used for this purpose a galvanized iron box on wheels, which may be drawn out to be emptied. The capacity of this box is from one to two bushels, enough for from one hundred to two hundred uses of the closet.

When a closet can be so arranged as to have its deposits dropped into a vault in the cellar, a stationary pail, with a hinged bottom, takes the place of the hod. This can be emptied from time to time, by lifting a handle connected by a rod with a movable bottom. If the closet is on an upper floor of the house, the bottom of the pail opens into a galvanized iron pipe, conveying its contents to the vault in the cellar. A more full and copiously illustrated account of all these drains than it would be possible to give here may be found in a pamphlet on the subject, prepared in 1870.* A cheaper form of commode (Newton's ottoman) than the one described above is shown in Figs. 3 and 4. This commode is especially adapted for use in bed-rooms, in the sick chamber, and generally where only occasional accommodations are required. It is exceedingly compact, and has the advantage of not showing, by its

* Earth-Closets and Earth-Sewage. Published by the Tribune Association, New York.

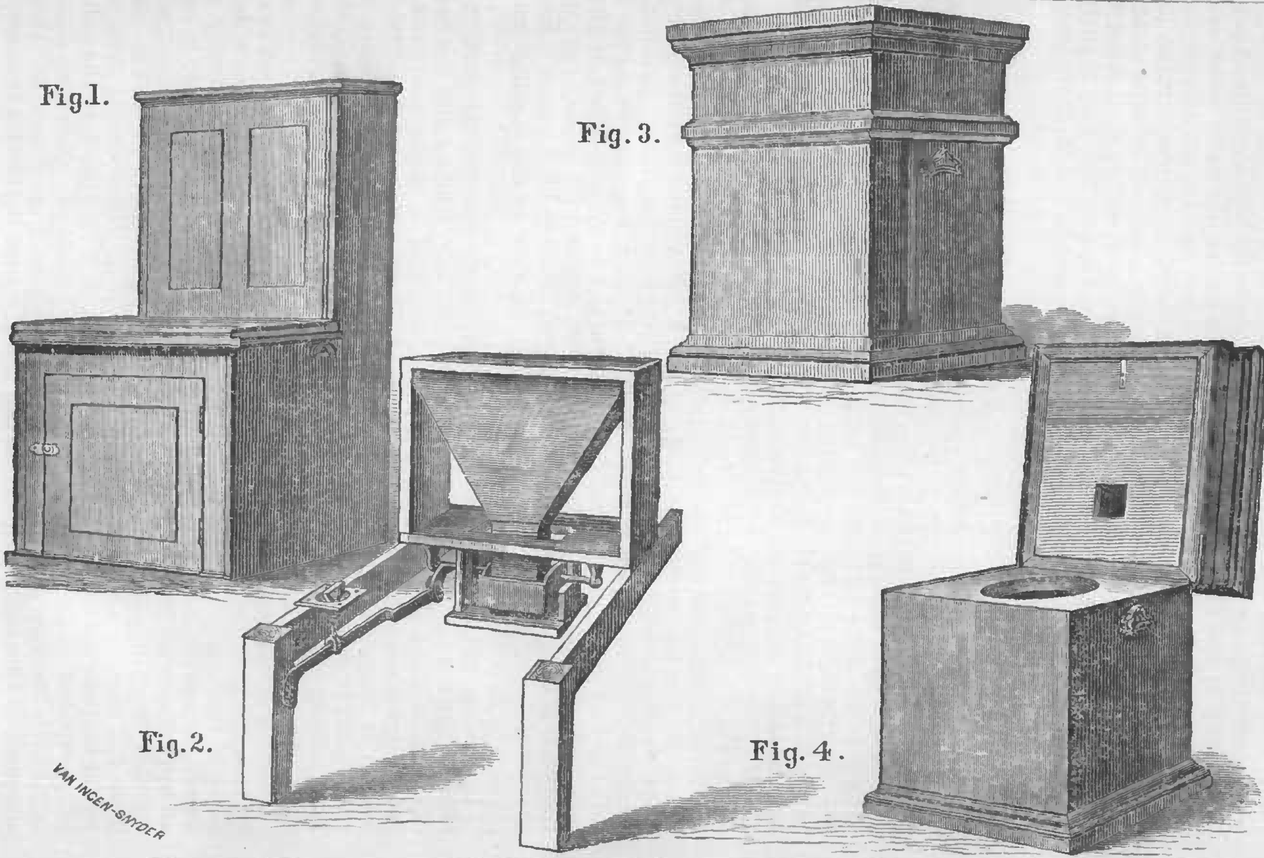


PLATE XXIX.

Fig. 1. Moule's Earth Commode. Fig. 2. Its mechanical parts. Fig. 3. Ottoman commode. Fig. 4 The same open.

form, the purpose for which it is intended. The prepared earth—say enough for ten uses—is contained in the cover, which is so arranged as to separate the requisite change of the disinfectant whenever it is raised up, and to shoot this upon the deposit in the hod below as it is closed. The device is a very ingenious one, and this commode has given great satisfaction wherever it has been used. Containing no movable machinery whatever, it is not at all liable to get out of order. The management of the earth is effected entirely by the shape of the reservoir in the cover, and by the position of the pipe through which it is discharged—all the distributing parts of the apparatus being fixed and immovable.

THE EARTH TO BE USED.

Mr. Moule very tersely says: "The earth-closet will no more work without dry earth than a water-closet will work without water." That is to say, the apparatus is intended to cover an offensive material with one that will render it inoffensive. The water in a water-closet is intended to wash the offensive matters away, and the earth in the earth-closet is intended to cover them up, and to absorb their odors. In either case the corrective agent must be present, or its effect will not be produced. The following directions should be observed:

1. The earth for use in closets must be dry; not necessarily dried by artificial heat, but made as dry as it can be, by exposure to the air and by the exclusion of rain.
2. It must contain enough alumina (clay) or organic matter, or oxide of iron, to give it sufficient absorbing power.
3. It must be sifted of its stones and coarser particles.
4. If the earth is to be again used, its organic matter must be destroyed by fermentation, and its moisture evaporated.

In stating that the earth must be dry, absolute dryness is not intended. The earth of the closet will always contain what moisture may be absorbed from the atmosphere. This, and even a little more than this, I have found to be not at all objectionable. What is required is, according to Professor Joy, that so much of the moisture of the feces shall be immediately withdrawn from them, that there shall be too little left to cause an offensive putrefaction.

The best manner for drying the earth depends very much upon the quantity required, and the means at command. Two or three cart-loads, which will be sufficient for a year's use of an ordinary family, may be taken from a plowed field, or a roadside gutter, during the dry weather of summer. Dumped in an out-of-the-way corner under a wood-shed, or in any other dry place, being underlaid with boards to prevent it from absorbing the moisture of the earth, it will soon become sufficiently dry for use, and will remain so throughout the dampest and foggiest weather of the winter or spring. It might be equally well kept in a dry and well-ventilated cellar. It may be sifted, little by little, as wanted; and it will answer tolerably well if it is merely put through the ordinary coal-sifter, though something finer would be preferable. The sieve used by the writer has six meshes to the inch; perhaps four would do as well. When the earth is sifted, it may be stowed away in boxes or barrels, in some easily accessible place, and there remain until wanted for use. This is sufficient for the requirements of a private house.

There is undoubtedly a great deal of difference in the effectiveness of earths of various composition, though it is probable, in view of a wide range of experiment and observation, that the kinds of earth which are *not* suited for use in the closet are much fewer than would be generally

supposed. Pure sand and gravel are worthless; but any earth that contains enough clay or organic matter for the production of ordinary crops, will answer the purpose. A nearly pure clay, however, is objectionable from its tendency to absorb moisture from the air. If to be used only once, an equal weight of muck or peat may be, from its greater bulk, more valuable than clay, though the clay can be used many more times. Probably a clay loam, highly charged with oxides of iron, (notably reddish clay loams,) would be the best.

In the country, where the manure is to be applied directly to the garden, it will be better to use the earth but once, as there is an advantage in having it as bulky as possible, for more even distribution; but even in this case it should not be applied in its fresh state. It should be first thrown into a bin or into barrels, in which it will retain its moisture long enough for perfect fermentation. In this way its vapor will be destroyed, and its fecal matter will be diffused throughout the mass and absorbed by the earth; while the earth itself will have its own fertilizing constituents developed by the decomposition going on within it. When ready for use, the earth will be nearly indistinguishable from that freshly taken from the field; but its manurial power will be very much increased. If the manure is to be sold in the market, or is to be transported to any distance, it should be repeatedly used, in order that its value, in proportion to its bulk, may be as much as possible increased. The deposits taken from the closets should be carried to the earth-depot, thrown into compact heaps, moistened a little, if necessary, and left to ferment. After a sufficient time, these heaps may be shoveled over, and left to undergo a second fermentation. They may then be spread out to dry, or, better, removed to a drying-room, where there is a free circulation of air. After becoming dry, the earth may be passed through a screen, and the finer parts stored away for further use; the small amount of coarser matter may be again moistened and fermented. Of this latter the quantity will be very small, and it will consist of dried-up solid feces, which it may be found best to pulverize and use directly as manure; or it may be mixed with deposits freshly brought in from the closets. It will help the fermentation of these, and will be entirely absorbed. From much recent experience of the writer, in the substitution of anthracite ashes for earth, in whole or in part, the belief is confirmed that they are as good as any material that can be used. When passing through the closet, for the first time, they are inconveniently dusty—a difficulty that might be easily overcome by allowing them to become wet with rain, or by sprinkling them with a watering-pot, and leaving them in a heap, under cover, to dry. After having been once used, they are sufficiently free from dust. Soft coal-ashes should always be wetted, and then dried before being used, and they would probably be improved by being mixed (half and half) with earth. The ashes, which are now a nuisance, would by being used in this way be converted into a good manure; and after removal from the closet for the fourth or fifth time, having been left in a heap for the decomposition of their solid feces, they may be handled without the least offense. In fact, no one would at all suspect, either from their appearance or from their odor, that they contained the least impurity.

Mr. J. B. Smith, a market-gardener at East Hartford, Connecticut, makes the supplying of earth to closets and the removal of the accumulations a very considerable source of manure. He has a clay soil, and the only preparation he gives it is to store it in bulk in a large bin in his wood-shed. By keeping a few months' supply ahead, he finds it will always become sufficiently dry without any artificial heat. In a

similar way, at Newport, Rhode Island, a considerable amount of valuable manure is obtained, by supplying earth to closets, and no other means of preparation are found to be necessary. It is needless to say that the cost of attendance is amply repaid by the value of the manure obtained; and farmers and gardeners would always find it to their advantage to encourage the introduction of the earth system in their neighborhoods, for the sake of the manure that the supply of earth to closets would give them.

THE SUPPLY OF EARTH FOR PRIVATE ESTABLISHMENTS.

The details of the work of supplying a number of closets can readily be arranged by any one undertaking it. It is for the preparation of earth, or its substitute, by individual households that information is most needed, and it seems desirable to give directions with considerable minuteness. The earth used in the closet must be dry, as dry as it is possible to keep it by protection from rain, dew, and mist. However dry it may be made by artificial means, it will absorb the hygrometric moisture of the atmosphere, which could be excluded only by hermetical sealing. This amount of moisture, which is not perceptible to the sight or touch, in no way interferes with its efficiency. But it *must* be air-dry, or it will not fully accomplish its purpose.

The best and cheapest drying apparatus is the sun and wind of a summer-day. During a drought the parched surface of naked land is in precisely the condition needed for use, and a year's supply may then be taken into a close out-building or a dry cellar, and stored until wanted. Those who have not made or cannot make this provision may store damp earth in a well-ventilated dry place, from which mists can be excluded, and in a shorter or longer time, according to the climate, it will become dry, just as bread so kept would do. The writer once had a commode in constant use for nine months, and nearly all of his winter's supply of earth was dried and redried in a hogshead lying on its side, its open end facing the south, being protected from rain and mist by a close screen of rough boards leaning against it. The sun had very little chance at it, but the wind had, and the drying was sufficiently rapid for such a limited supply as was needed for one commode.

In the country, where earth is plenty, and where there is use on the farm or in the garden for the manure, it will be best to compost the accumulation of the closet until required for use, and to supply the closet with fresh earth; not because it is more effective than that which has been several times used, but because it is better to have the manure as bulky as possible, for ease of even distribution. But in towns, and in all cases in which the manure has to be transported to a distance, making it desirable that it be as concentrated as possible, the same earth should be used over and over again. It has been demonstrated that the same earth may be used six or seven times over, without losing its efficiency as a deodorizer.

Earth owes its deodorizing power to both its clay and its decomposed organic matter, and, as in the case of the soil of an old garden which has been heavily manured for many years, the manure itself, when thoroughly decomposed, only adds to the disinfecting strength of the earth by adding to its humus. In fact, instances are cited in which the same earth has passed ten times through the closet, receiving at each use an addition to its manurial value. Of course, in time the limit will be passed, and the preponderance of organic matter will tell on the

effect, so that it is found in most cases that six or seven uses are enough to reduce the deodorizing effect.

When the earth is removed from the closet or the commode it should be emptied into a barrel, a cask, or a bin, in a sheltered but well-ventilated place. Here it will soon so far decompose that all traces of paper and solid feces will disappear, and it will be to a considerable extent dried. It should now be worked over with a shovel or a rake until its parts are perfectly mixed, and it may be dried by natural or artificial means, as circumstances suggest, and prepared for another use. Until the decomposition of the foreign matters has become complete, it is better that the mass be kept in a compact body; after that, the more it can be spread, the more rapidly will it dry, though it will in time become dry in the barrel or bin.

In the case of fixed closets holding a three months' supply, it is hardly necessary to resort to any artificial means of drying, or even to any manipulation. The accumulation in the vault or box must be leveled off with a rake from time to time, and this will sufficiently mix the earth and feces. In such cases it would be the best arrangement to have two bins equal in size to the capacity of the reservoir and of the vault of the closet. These may be in a shed connected with the privy. One of the bins and the reservoir above the hopper being filled with sifted dry earth, and the other bin with freshly collected earth, we go on and use out the supply in the reservoir. In three months it has all passed into the vault, and is mixed with feces. We now fill the reservoir with the contents of the first bin, and put the contents of the vault in its place. When the reservoir is again empty, the earth that was freshly collected and moist six months before is dry and fit to be sifted into the reservoir, the bin from which it is taken being filled from the vault. When the reservoir has been again emptied, the first clearing of the vault will have had six months to become dry, and may be sifted and used. If the same earth is used six times over, the original supply will last four years and a half, at the end of which time it should be worth fully $50 per ton as manure. The quantity of earth that it is necessary to supply will depend on the frequency with which the closet is used, and on the quantity of earth that it is made to contain. Four barrels are found to be sufficient for a commode constantly used by three persons.

With such a reservoir, and two bins, each holding a three months' supply for a family of ten persons, each receptacle would require a capacity equal to that of a cube of three and a half feet, which would give an abundant supply for all emergencies for a period of from four to five years. Four times a year the earth should be sifted, and occasionally the contents of the vault be leveled off.

By Professor S. W. Johnson's estimate of the value of night-soil as manure, this amount of earth, after it has passed six times through the closet, would be worth from $200 to $250. Other estimates would give it a much higher value.

The earth for the closet must be not only dry, but sifted. Up to a certain point the finer it is, the more effective. That is, while it will answer the purpose if it is passed through a common coal-sifter, it will much better envelop the deposit, will distribute itself more widely, and will make more dust in every part of the vault (a desirable thing, on account of the exhalations from the uncovered fresh fæces) if it has been passed through a sieve having four meshes to the inch.

EARTH-CLOSETS UNDER THE CONTROL OF TOWN AUTHORITIES.

Suggestions upon this subject that are applicable to the majority of

cases are presented in the writer's Earth-Closets and Earth-Sewage, as follows: In preparing for the supply of a large town, it would be necessary to procure a land-right in order that deep excavations can be made. The amount of earth needed will be very large, and it must, of course, be procured in the cheapest way. This will be, in nearly all cases, by making a clean sweep as deep as it is economical to work, and making an acre of land produce as much earth as possible. The high price of land in the immediate vicinity of the town may make it desirable to go to a considerable distance, in order to secure cheap land and cheap transportation combined. The earth being procured, the first drying can be most economically done near the spot from which it was taken, by simply storing it under rain-tight and well-ventilated sheds.

The sifting of the earth is a very simple matter, when it is a question merely of the supply of a single household. When large quantities are required, it would be more economical to use revolving screens, such as are used for cleaning coal at mines, the construction being similar to that of the bolting-screen of a common flour-mill. Such a screen should be probably twenty feet long, the first half of its length being furnished with quarter-inch meshes, the next half with half-inch meshes. Stones and very hard large lumps would be discharged at the end of the screen; the coarser particles passing through the half-inch mesh might be broken up in a stamping-mill and resifted. If the screening-house were built in a side-hill, so that carts could lead directly to the screen, and the prepared earth fall to a story below, much necessity for shoveling would be obviated.

In the case of towns where the system is in anything like general use, the care of the closets should devolve almost exclusively upon associations or individuals engaged in the business of earth-supply. I am convinced that, in all places where manure has even a moderate value, it will be unnecessary to make a charge for earth and attendance. The preparation of the earth and the amount of transportation constitute a trifling tax when compared with the value of the product. When the business increases, so that the time of a man and a horse and cart will be constantly employed, the details can be somewhat simplified and the rounds made with more regularity; the only precaution necessary being to have always an abundant supply of earth ready in advance, so that protracted wet weather will not require regular delivery to be postponed in order to make use of the first fair weather for securing earth.

The Dry-Earth Company, of New Haven, have adopted the rule of charging a moderate price for the first supply of earth, exchanging it without cost whenever necessary. This is done to prevent the use of manure by householders. Wherever the demand is sufficient for the business to be regularly systematized, the earth may be delivered as ordered, just as coal is now delivered from coal-yards, and it would be proper to make a charge for "carrying in," as in handling coal. If the cart is suitably covered against rain, it is most convenient to carry the earth in bags.

The deposits may be removed in baskets, and emptied into the carts on their returning rounds. Barrels are too heavy for one man to handle, and are less convenient than bags for filling closet-reservoirs.

In places where manure has not sufficient value to pay the cost of attendance, the charge necessary to make a profitable business of attending to a considerable number of closets would be much less than the water rates and plumbers' bills, that are an inseparable part of the water system. If ashes are used, the addition of the closet manure to

them will not materially increase the cost of their handling, and it will give them a value which they do not now possess. If the preservation of the manure is not an object, the removal of the accumulations may be provided for as is now done in the case of ashes, &c.

The public authorities should, in all cases, assume such control of the matter as to insure the perfect working of the system; but the manner in which private establishments shall be supplied with earth is a question to be decided by the peculiar circumstances of each case. Just as no water-closet should be allowed to remain in use without a supply of water, or with an obstructed soil-pipe, so should no earth-closet be allowed to become ineffective from the neglect of its owner to provide it with earth, or to have its accumulations removed. It is now necessary, in even the smallest towns, to prevent any outrageous neglect of common privies; and the extension of the same system of inspection to meet the requirements of the dry-earth sewage, would be neither difficult for the authorities nor onerous to householders.

KITCHEN AND CHAMBER SLOPS.

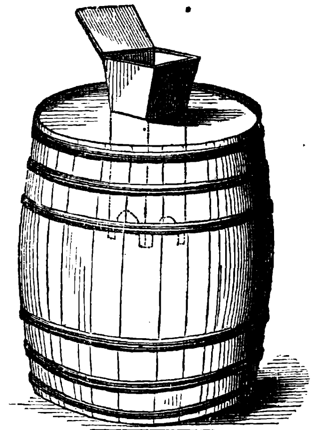
The work of economy and purification that the earth-closet accomplishes in such great measure would remain incomplete without some measure for the satisfactory disposal of the liquid wastes of the house. In most houses in the country these wastes are either allowed to run off through a drain from the kitchen-sink, to form a disgusting pool on the surface, conveyed to a cess-pool from which they leach away into the ground, (and often into the well,) or dumped into the vault of the privy, where they add to the offensiveness of the noisome stench of its other accumulations. No effort is made to convert them to any use as manure, nor to avoid the danger of their putrefaction.

There are two ways in which they may both be made inoffensive, and be rendered available as manure. The first and simplest is described in the pamphlet of the writer as follows: Houses may be relieved of their liquid wastes by filtering them through earth in a large cask, or other vessel. This plan I have had in operation for more than a year; first, during the winter of 1868–'69, under the kitchen-sink of my gardener's house, there being five persons in the family. A single charge of earth lasted for four months. At the end of that time, the water oozing from the bottom of the hogshead was slightly discolored, and its contents were required to be renewed. Frost was excluded by filling the upper six inches of the barrel with horse-manure. This allowed the infiltration of the liquid even in coldest weather. When the contents of the cask were removed, they were spread upon one of two parallel cold frames, intended for lettuce. The corresponding frame received $20 worth (two and a half cords) of livery-stable manure. The land had not previously been manured for a long time. The crop grown by the cask-manure was much the more luxuriant and valuable of the two.

This experiment having proved so successful, when I arranged for the disposal of my kitchen-drain, as hereafter described, I prepared a similar cask in my own garden to receive the chamber-slops of the house. This cask, with a leaky bottom, stands on the top of the ground, and is filled three-fourths full with earth (the unprepared surface-soil of the garden.) It is covered with a round cover of matched boards, well battened together, and provided with a funnel similar to the one shown in Fig. 5, having a closely fitting flat cover, which is ordinarily kept closed. This hogshead was put in use in August. Before very long the earth,

which contained a good deal of clay, was so puddled as to prevent the entrance of the liquids, or at least admitted them very slowly, so that there was usually water standing in the funnel. This was remedied for a time by filling in with coal-ashes on top of the earth. How long this would have lasted in warm weather I cannot say. It worked well until it froze. I then had all of the ashes and a little of the earth removed, and packed the upper part of the barrel full with very coarse stable-manure, fully three-fourths straw. The funnel was also half filled with the same material. This was about the middle of November, and, as I write, two months later, the operation is perfect—the entire up-stairs waste of the establishment being completely disposed of, and there being as yet no indications that anything but clear water (plenty of that) has escaped at the bottom.

Fig. 5.



The cost of such an apparatus as this is too trifling to be considered, in view of its great value as a means of ridding ourselves of one of the worst pests of ordinary village housekeeping. The same cask may receive both the up-stairs and down-stairs wastes, just as the same system of drains might do.

This cask continued to answer its purpose perfectly for more than a year, the earth being changed once in about four months. It was kept in use until the following system was substituted for it as being more complete, and obviating the necessity for carrying the slops to it.

This second arrangement was first described in Mr. Moule's pamphlet as follows:

Where there is a garden, the house-slops and sink-water may in most cases be made of great value, and removed from the house without the least annoyance. The only requirement is that there shall be a gradual incline from the house to the garden. Let all the slops fall into a trapped sink, the drain from which to the garden should be of glazed socket-pipes well jointed, and emptying itself into a small tank eighteen inches deep, about a foot wide, and of such length as may be necessary. The surplus rain-water from the roof may also enter this. Out of this tank lay three-inch common drain-pipes, eight feet apart, and twelve inches below the surface. Lay mortar at the top and bottom of the joint, leaving the sides open. If these pipes are extended to a considerable length, small tanks, about one foot square and eighteen inches deep, must be sunk at about every twenty or forty feet, to allow for subsidence. These can easily be emptied as often as required; and the deposit may be either mixed with dry earth, or be dug in at once as a manure. The liquid oozes into the cultivated soil, and the result is something fabulous. This simple plan will effectually deal with the slops; there is no smell, no possibility of any foul gas to poison the atmosphere, and with this, and the produce of the earth-closet, any ground may be productive and profitable.

The two following facts will illustrate the value of this system of dealing with house-slops, &c.

On a wall fifty-five feet in length and sixteen feet high, a vine grows. A three-inch pipe runs parallel with this at a distance of six feet from it for the entire length; the slops flow through this pipe, as above described. On this vine, year after year, had been grown four hundred well-ripened bunches of grapes, some of the bunches weighing three-quarters of a pound. During a period of four years, for a certain purpose, the supply was cut off. To the surprise of the gardener scarcely any grapes during those years appeared; but afterward the supply was restored, and the consequence was an abundant crop; the wood grew fully sixteen feet, of good size and well ripened.

The other case was as follows:

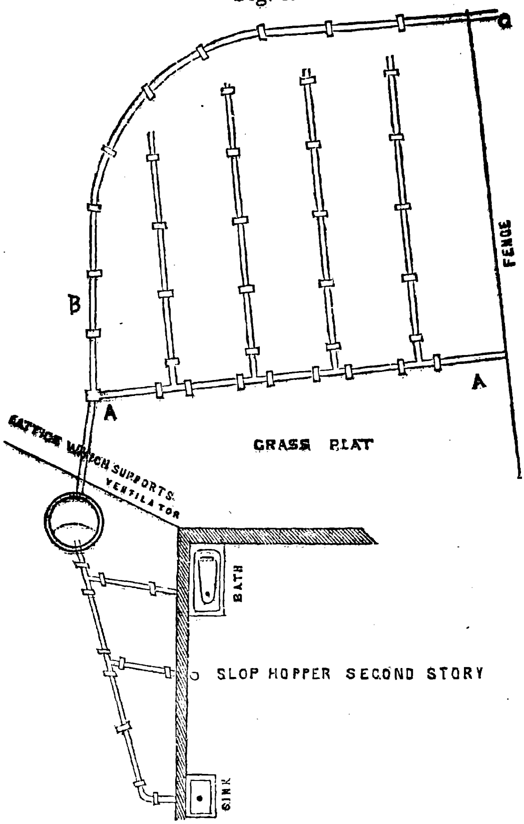
Pipes were laid below two square yards of earth, twelve inches beneath the surface, which were fed with the slops through an upright pipe, about one large watering-

potful daily. In the month of November three roots of Tartarian oats were planted in this piece of ground. The stalks attained one inch and a quarter in circumference; the leaves measured an inch across. Several of the ears were twenty-six inches long, and when the crop was gathered, eight hundred grains were rubbed out of one ear. The whole weight of corn from those plants was three-quarters of a pound. Twelve of these grains were put into the same piece of ground the following year. From these was grown one pound and three-quarters of seed. In fact, in a garden of twenty perches, by the use of both solid and liquid manure from one house, three crops were grown in the year, the value of which, at market price, would be twenty pounds.

In a garden in which this plan has been adopted for eight or ten years the pipes were recently taken up in order to see how far they might have been filled with the mud of subsidence. After so long use, very little subsidence was found and none to obstruct the working of the system, excepting where, in one or two places, the bad laying of the pipes caused some obstruction. There was nothing which might not at any time be remedied in half an hour.

After several experiments, a plan was adopted substantially the same as that shown in Fig. 6. The drain from the kitchen-sink, the waste-pipe from the bath-room, and the down-pipe from a slop-hopper on the second floor into which all the liquid wastes of the sleeping-rooms are poured, enter a four-inch vitrified pipe, cemented at the joints which leads to a cemented brick cistern about thirty feet distant, perfectly water-tight. A curved piece at the end of this pipe turns down into the cistern about one foot below its point of entrance, which is very near the surface of the ground. On the opposite side, also near the surface, another four-inch vitrified pipe, with cemented joints, leads off to a small, square, cemented cistern, twenty feet farther on, in the edge of a grass-plat. The first cistern is covered with a stone laid in cement, and a ventilator about eight feet high rises from it by the side of a lattice. The downward curve of the pipe leading from the house, delivering below the surface of the liquid in the cistern, is thus prevented from conveying back to the house the foul gases that are formed there. These escape through the ventilator. The downward curve of the pipe leading to the second cistern receives the overflow at a point below the surface, thereby preventing the scum entering the cistern from entering the drain to choke it up. This cistern is about three feet in diameter, and three feet deep. The second cistern, which is a cube of about two feet, made tight with hydraulic cement, has the inlet-pipe pre-

Fig. 6.



viously described and two outlets, all near its upper edge, the outlet marked A being some three inches lower than that marked B. The outlet-drain A is four inches in diameter at its commencement, three inches in diameter for the second third of its length, and two inches for the remainder. This drain and the laterals leading from it are made of common agricultural drain-pipes, one foot in length, connected with collars at the joints, but open enough for the liquid to leak out at every joint. They are all laid from ten to twelve inches below the surface of the ground, which is permanently laid down to grass. The drain B is made in the same way of two-inch pipes, with collars.

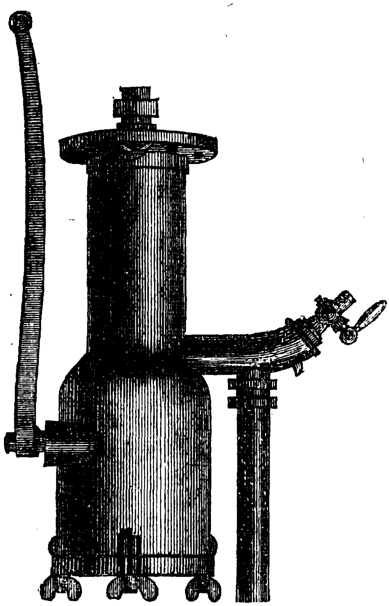
The operation of this system is as follows: All the liquid waste of the house, amounting, perhaps, to one hundred gallons daily, passes through the main drain, is delivered into the cistern below the surface of its water, (deposits its heavy sediment below and its grease scum above, any foul gases that may be formed passing off through the ventilator,) displaces an equal amount of the liquid in the cistern, forcing it off through the outlet-drain, the entrance to which is below the scum and above the sediment. It then passes on to the second cistern, where it enters the pipe A, and soaks into the ground at a point within reach of the roots of the grass, causing this to grow with great luxuriance, and being decomposed by the action of the air, with which this upper layer of the soil is filled, so that it is prevented from having any hurtful influence. Should matter accumulate in the drain A to such an extent as to obstruct it, the liquids would rise in the second cistern, and flow off through the drain A, showing themselves at the mouth of this drain A, in the street-gutter, where their appearance would indicate the trouble, and show the necessity of taking up and cleaning the drain A and its branches, a job that would require not more than a half day's labor. The top of the second cistern is covered with a flagstone below the surface of the ground. The ground has but a slight fall, not more than two feet from the house to the outlet of the drain B, only enough to cause the water to move slowly.

This system has been in constant operation for nearly two years, including two very severe winters, and during the whole time it has worked perfectly, giving as yet no indication that the cleansing of the drains will be necessary. As only a thin liquid leaves the first cistern, there is no reason to apprehend the obstructing of these drains for an indefinite time to come. If the land occupied by these drains were kept for hay, I am satisfied that the extra production caused by their fertilizing influence would be worth more than enough to pay the interest on the entire cost of the work. All danger of infection, and of the leaching of the liquids into the deeper strata of the soil, is entirely obviated. In short it would be difficult to devise a system by which these troublesome wastes could be more simply and more safely disposed of.

In the early part of this article allusion was made to the very proper dislike of women to carrying water to the second floor of the house, and to the untidy practices to which their equally natural dislike to carrying down chamber-slops gives occasion. In connection with the introduction of the earth-closet and the waste-water drain before described, there should be in every house making the least pretension to convenience a means for forcing water to a tank on the upper floor, and, also, a slop-hopper on that floor, into which its liquid accumulations may be poured. After the provision of an earth-closet, to which at least the females of the family can have access without exposure, no luxury can be so easily and cheaply provided as this style of water conveniences upstairs. There

are various forms of pumps, more or less costly, for forcing water, some of which answer the purpose admirably, at a cost of $10 to $15, as seen in Fig. 7. No arrangements, however, would be complete without some system for emptying chamber-slops, without carrying down-stairs. A simple wooden spout, made of four boards, running down outside of the building, ventilated at the top, would be the cheapest, and much better than nothing. It will be best, however, in all cases, to use either earthenware drain-pipes or the thin lead pipe, made expressly for this purpose. With a strainer in the hopper, a one and a half inch pipe will suffice. As it is difficult to keep such pipes from freezing in country houses, it is better to have them so arranged that the water will never stand in them. This will require the trap to be placed in the cellar, or under the surface of the ground, and the hopper must be supplied with a cover to prevent the slight odor that will gather in the pipe itself from escaping into the house. There will be no danger of the freezing of the pipe leading from the pump to the second floor, as in winter the stop-cock is left open, so that its contents may run out.

Fig. 7.



This simple arrangement for water supply is not, of course, a part of "Moule's dry-earth system." Indeed, it has no necessary connection with it, and may easily be adopted where earth-closets are not desired. It has been described in connection with the earth-closet system, because it supplies the only thing wanting to give that every advantage which the water-closet has.

This article cannot be more appropriately closed than with the last paragraph of a letter concerning the system from Professor J. W. Jackson, of Union College:

"*As to the value of this joint result of discovery and invention, considered in all its relations, sanitary and economical, as productive of decency and comfort, and supplying an important desideratum for every human habitation, it is impossible to overestimate it.*"

STATISTICS OF FENCES IN THE UNITED STATES.

It has been a mooted point, in the past, whether fences were intended to avert the destruction of corn by the cattle of neighbors, or to restrain one's own stock from similar depredations. For a long time the popular idea, logically interpreted, appeared to be that corn should be restrained to prevent depredations upon cattle. Another question, of which a solution has been desired, is whether the money invested in farm-stock or that in farm-fences is the greater sum. It is certain that the fence investment is a large one, and strongly suspected that much of it is avoidable and unprofitable. While rapidly paying the national debt, it is possible that the American people may discover a means of reducing another of almost equal proportions. In the one case the annual tax is a fixed sum, which is less than legal interest upon the entire principal; in the other, it is legal interest on the whole amount, and a still larger tax for depreciation of the principal, thus more than doubling the tax, and rendering the fence debt a heavier burden than the war debt.

It is beginning to be seen that our fence laws are inequitable in a greater degree than is required by the principle of yielding something of personal right, when necessary, for the general good. When a score of young farmers "go West," with strong hands and little cash in them, but a munificent promise to each of a homestead worth $200 now, and $2,000 in the future, for less than $20 in land-office fees, they often find that $1,000 will be required to fence scantily each farm, with little benefit to themselves, but mainly for mutual protection against a single stock-grower, rich in cattle, and becoming richer by feeding them without cost upon the unpurchased prairie. This little community of twenty families cannot see the justice of the requirement which compels the expenditure of $20,000 to protect their crops from injury by the nomadic cattle of their unsettled neighbor, which may not be worth $10,000 altogether. There is also inequality in the tax which fencing levies upon the farmers, the rate of which increases with the decrease of the area; for example, a farmer inclosing a section of land, 640 acres, with a cheap fence costing but $1 per rod, pays $1,280 for as many rods of fence, or $2 per acre; another, with a quarter section, 160 acres, pays $640, or $4 per acre; while a third, who is only able to hold 40 acres, must pay $320, or $8 per acre. Thus the fencing system is one of differential mortgages, the poor man in this case being burdened with an extra mortgage of $6 per acre which his richer neighbor is not compelled to bear. All these acres are of equal intrinsic and productive value, but those of the larger farm have each but a fourth of the annual burden thrown upon the smaller homestead, and the whole expense may be for protection against trespassing cattle owned by others.

But it is not proposed to discuss the fence question. It is necessary, first, to obtain possession of its facts, ascertain what kinds of fence are used, the number of rods of each, and the cost of each. The census furnishes no light upon it, and local collections of these essential facts are few and imperfect. The best that can be done at present is to seek county estimates of kind, amount, and cost, from careful analysis of ascertained facts. As a preliminary effort in this direction, in the absence of a thorough census, the following series of questions was addressed to the regular statistical correspondents of this Department:

1. What descriptions of farm-fences are made in your county; if of

more than one kind, the proportions of each, expressed as percentages of the total quantity?

2. What is the average height and prevailing mode of construction of each kind?

3. What is your estimate, for the farms of your county, of the average number of rods of fence to each one hundred acres of farm-lands, including together improved and unimproved lands?

4. What is your estimate, for the whole county, of the average size (number of acres) of inclosures or fields?

5. Average price of boards used for fences, per thousand?

6. Average price of rails per thousand?

7. What proportion of openings have bars and what proportion gates; style and cost of gates?

8. Average cost per rod of worm-fence; of post and rails; of board-fence; of stone wall; of other kinds?

9. Average cost per hundred rods of annual repairs of all farm-fences?

10. What kinds of wood are used as fence material, and what the relative cost of each?

11. What is the comparative durability of each kind?

Returns were made from 846 counties, nearly all answering every question, some very fully. As a sample of the most exhaustive, the following, from Hon. John M. Millikin, of Butler County, Ohio, is given in full:

1. Our farm-fences consist of common worm rail fence, and (what can hardly be called a fence) of osage-orange hedge. There are no data by which to determine accurately the proportion of each. My estimate is 80 per cent. rail-fence, 15 per cent. board-fence, and 5 per cent. hedge-fence.

2. Our worm rail fence varies in height. They are from seven to nine rails high, including riders. Our board-fence is usually made of 16-foot boards, 1 inch thick and 6 inches wide. Posts 8 feet apart. Black locust posts always preferred. Red cedar, white cedar, and oak posts all used, and esteemed for durability, in the order named. Most people make their board-fence five boards high, and then cap it. Recently many are only using four boards, and capping with the fifth.

3. In 1857 I made a very careful estimate of the number of rods of fence in this county, and the cost of the same. I also estimated the annual interest on the same, and the annual expense of keeping the same in repair. These estimates were made for the purpose of showing the necessity of having a law enacted to prevent cattle from running at large. I presented my statement to the State Agricultural Convention, and the ultimate result was the passage of a very valuable law restraining cattle from running at large. As yet, it is not generally enforced, but is accomplishing good results. My data, then used, I cannot find, and must, therefore, hastily make another estimate. So much preliminary. Our farms, of 100 acres each, will average from 875 to 950 rods of fence—say fully 900 rods.

4. We have in this county about 4,000 farms, varying in size from 30 acres to 400 acres. Of the latter we have some thirty or forty. Each farm, on an average, will have about eight fields, and we have, therefore, "of inclosures or fields," at least 32,000. This estimate does not include numerous small lots which every farmer has in immediate connection with the barn-yard.

5. The average price for fencing-boards is about $22 per thousand.

6. Good oak rails are worth $70 per thousand.

7. Nearly all inclosures are now provided with gates. There are scarcely more than one pair bars to fifteen gates. In some neighborhoods bars have been entirely superseded by gates. Gates are usually made with common fencing-boards, one inch thick and six inches wide; a post 3 by 4 at one end and 2 by 3 at the other end. Braces of boards of like size, extending from bottom of the larger post to the top of the smaller. Cost about $3.

8. New worm-fence will cost about $1.75 per rod. Post and rail fence has almost gone out of use. I have seen none made within the last twenty years, with the exception of one string. It would cost per panel of ten feet, about $1.80. Board-fence per rod, good lumber, and locust or red cedar post, will cost about $2 four boards high, and $2.15 to $2.20 five boards high. Stone walls are not constructed and used as fences in this county.

9. I know of no way of answering this question satisfactorily, as the annual repairs will so much depend upon the age, material, &c., of the fence. From the investiga-

tions I have made, I am satisfied that it will take 15 per cent. per annum of the original cost of the fence to pay interest and keep up repairs.

10. Farmers prefer oak and walnut rails. The latter would probably cost $120 per thousand, and are not now used. Where rails are used now, farmers are willing to make them out of almost any kind of timber. Where board-fence is made, pine boards are preferred. Locust and red cedar posts are preferred, costing about 35 cents each. Oak posts are somewhat cheaper but less durable.

11. Locust posts are believed not only to be stronger than cedar, but they hold nails better and are more durable.

Permit me to add further. We have in this county 293,000 acres of land, all inclosed. We have at least 2,600,000 rods of fencing, some costing largely more, yes, four-fold the price at which I have estimated our fences per rod. But for the purpose of estimating the annual cost of maintaining our fences, including interest, let me put the average at $2 per rod; 2,600,000 rods of fence, at $2, will cost $5,200,000. Annual cost of maintaining same, (including interest,) at 15 per cent. on original cost, $780,000. These figures are astounding, and yet I believe that they are not too high. Material for rail-fences will soon be out of the question, and lumber of every kind is annually becoming scarcer, and necessarily will increase in price. Is it not, therefore, highly important that laws restraining stock from running at large should meet with more favor; that fields should be enlarged; that soiling should be more practiced, and that farmers should thereby be relieved from the great burden of paying such immense sums for fencing?

KIND OF FENCES AND MODE OF CONSTRUCTION.

The replies are necessarily monotonous from their repetition of details; they show that the common forms of fencing are substantially alike in all parts of the country, yet varied everywhere to accommodate the differences in kind, quality, comparative scarcity, and cost of timber; and present the Virginia rail-fence as the pioneer in all timbered districts, from the simplicity of its construction, not even requiring nails, but rails only. The tendency to supersede this form with a fence requiring less timber and occupying less space, while presenting to the eye more artistic features, is manifestly growing. The following extract from the returns of our correspondent in Rutherford County, Tennessee, shows that this tendency is already pervading a State which has yet half its farm-lands in forest:

There can be no objection to the red cedar rail-fence on the score of first cost or durability; but there is a most serious objection to all worm-fences. The writer has, upon a farm of 475 acres, about five and a half miles of worm-fence and one mile of plank-fence; also one-fourth mile of good stone fence. The stone and plank fences occupy only the ground they stand on. The five and a half miles of worm-fence occupy five acres of land, and keep out of cultivation nearly if not quite eleven acres of land. The cost of keeping down weeds, briars, &c., along these five and a half miles of fence—eleven miles of fence-corners—is a tax greater than my State and county tax for this year, and was poorly done at that.

A description in detail of the minute differences in construction, even as reported from the counties of any single large State, would require a score of printed pages; and the additional information in drawings and descriptions necessary to a thorough understanding of the peculiarities and variations of each kind of fence would fill a volume. Only a brief classification of the more essential facts embraced in these returns will therefore be given at present, with the hope of approximating the total amount and cost of the fences of the United States.

The fences of Maine are of many kinds and of various construction. Stone-wall is more generally distributed than any other substantial fence, about one-fifth of the inclosures being walled in, York County reporting 30 per cent., Hancock 29, Waldo 25, and other counties a smaller proportion. The post and rail style is next in prominence, especially in Somerset and Hancock, surrounding nearly three-fourths of the inclosures of those counties. Board-fence is used for four-tenths of

the fields of Cumberland; for one-fifth of those of York and Oxford; and one-fourth of the farms of Waldo. Brush-fence predominates in Oxford, being used for three-fourths of all inclosures. The height of Maine fences ranges from 4 to 4½ feet. There are structures which pass as fences that are still lower. The board-fences are of various patterns. In Oxford a desirable style is made of 8-inch boards, nailed to posts 8 feet apart, and battened with a perpendicular strip upon each post. In York, except near buildngs, the boards are confined with withes. In Sagadahoc, where timber is getting scarce, three or four boards to each length are used, and posts are set on stone, iron dowels entering the wood 8 inches. A "cap and bunk" fence of cedar is the style in Aroostook; the rails cut 18 feet long, and lapped to make each length a rod; a "bunk," or block, about 4 feet long, laid under the end of each length, and a cap at the top, holds the stakes together. "Hedge-fence" is made of fallen trees. In Waldo half the inclosures have worm-fences. As material for fencing, cedar is used wherever it can be obtained, and hemlock, spruce, oak, pine, poplar, and other woods.

A similar variety is found in New Hampshire. The worm-fence (Virginia) surrounds one-fourth of the fields of Coos. Board-fences predominate in Coos and Strafford, half of all being of that sort. The post and rail is largely used in all parts of the State; and brush, stump, pole, log, &c., are common. Stone-wall is largely used in all rocky districts, both single and double, of all widths, from 2 feet to 6 or more, according to the quantity of stone for which no other disposition is so convenient. In Hillsborough it constitutes three-fourths of the fence; in Strafford, one-half; and a large proportion in all other counties.

Worm-fence is common in several counties in Vermont, the proportion being 90 per cent. in Grand Isle, 65 in Addison, 25 in Washington. In the latter county the rails generally rest on stone 8 inches high, and six rails to the panel are used. Boards are used for half the fences of Washington and Essex, and are largely employed in Orleans and Windsor. One-fifth of Addison fences are made of stumps, standing about 5 feet high, roots upward. About one-fourth of the fencing of the State is made with stone, the proportion in Essex and Windsor being fully 50 per cent., and 25 in Washington, 20 in Orleans, and in Addison and Grand Isle scarcely more than 5 per cent. Stone at bottom, with stakes and rails above, is used to some extent. Cedar rails are common in Orleans.

Stone-wall is the main fence in Massachusetts, its proportion reaching to 75 per cent. in Essex, 67 in Norfolk, 40 in Dukes and Bristol, in Plymouth 60 per cent. stone and wood combined, and 10 per cent. of stone alone. Nearly half the fences are of stone, or stone and wood combined; fully one-third post and rail fence, 3½ to 4½ feet high, of which Dukes has 60 per cent., Hampden and Bristol 40, Norfolk 33, Plymouth 30, and Essex 20. In Hampden stone-walls are very substantial, many being 4 feet wide at bottom, and 3 at top.

Rhode Island is mainly fenced with stone, scarcely any other material being known in Newport, Bristol having 75 per cent., and Washington 60; height, about 4½ feet. A foundation two feet deep is sometimes laid with small stone. The rail-fence is 4½ feet high, of 5 rails; and the posts of board-fence are set 2½ to 3 feet in the ground, 8 feet apart. All fences and gates are comparatively substantial and thorough in construction.

Stone is the material for one-third of the fences of Connecticut, New London having 70 per cent. of wall, Fairfield 50, and other counties a

smaller proportion. Post and rail fence incloses three-tenths of the fields; worm-fence nearly one-fourth; board-fence one-eighth; height, 3½ to 4½ feet. In Middlesex, where a poor quality of stone is available, walls 3 feet high are common, with stakes and rails above. In New Haven similar fences are made, the wall 2½ feet high. These walls are preferred to the regular stone-wall for sheep-pastures. Six rails are said to make a legal worm-fence; heavy rocks are often placed under the corners; and a fence built with 1½ to 2 feet of stone, with 3 rails above, is deemed a good fence.

An averaging of thirty-three reports from New York indicate a predominance of worm-fence, of which there appears to be 45 per cent.; 18 per cent. of post and rail, and 19 of board; 18 per cent. being stone-wall and other kinds, including a small amount of wire, picket, hedge, &c. Orange has 80 per cent. of wall; Putnam 75, and Greene, Dutchess, Columbia, and Delaware, 50 per cent. each. Of post and rail, Kings has 95 per cent., Warren, 80, Cattaraugus, 70, Saint Lawrence, 67, Steuben, 65, Saratoga, 50. Worm-fence is found in large proportion in the following counties: Orleans, 90 per cent.; Yates, 85; Niagara, Jefferson, Monroe, 80; Wayne, Genesee, Schuyler, Otsego, Livingston, Ontario, Lewis, 75; Wyoming, 70; Chenango, 60; Seneca, 55; Onondaga, Cortland, Queens, Greene, 50 per cent. Madison reports 80 per cent. of board-fence; Schenectady, 50; Tioga, 45; Fulton, 33; Cattaraugus, 30; Saratoga, Washington, and Onondaga, 25 each. A part of the worm-fence is staked and ridered, and some is wired, and varies from 4 to 5½ feet high, the latter only in Livingston. Post and rail is usually 4 to 5 feet high, averaging about 4½ feet; breadth of worm, usually 4 feet. Where poor stone prevails rived sticks are used in stone-wall, to bind it. Stone-wall is built entirely of stone, or is combined with rails or boards for the upper portion of the fence. In Seneca, wire and picket fence meets with general commendation for cheapness and durability. Board-fences differ considerably in length of panel and number and quality of boards. Hemlock is much used, in the scarcity of other material. In Erie, "a beginning has been made to dispense with fences." A large proportion, not less than 60 per cent., of New Jersey fences, are of the post and rail style; the posts of white oak, chestnut, white and red cedar, and "fat" pine, 6 or 7 feet long, round or sawed, set 2½ feet in the ground, 11 feet apart, some having three or four mortises for the rails, (which are cut 12 feet long, and sharpened,) and others are nailed to the posts. About 30 per cent. of inclosures are surrounded by the worm-fence, of chestnut or cedar rails chiefly, which are laid in angles of 25 degrees, with stakes set in the ground, and double ridered.

The post and board fence is found in Hunterdon, Ocean, Morris, and other counties, being used in the former for one-fifth of the inclosures. The osage-orange hedge is employed to some extent. A few stone-walls may be seen, and brush, turf, and other modes of fencing. In Bergen and Union all the fence is reported to be of posts and rails, and 90 per cent. in Essex and Hudson, and 60 in Morris.

Two-thirds of the fences reported in thirty counties in Pennsylvania are of the zigzag "Virginia" style, one-sixth are of post and rail variety, one-eighth constructed of boards, and the remainder stone-wall, osage-hedge, stump, pole, or other kinds. Most of them are 4½ feet high, some 4 feet, some 5. In Luzerne worm fence is 5½ feet, and in Westmoreland it is 6 feet. In Beaver there is no other fence reported; little else in Butler, in Warren, or in Somerset; 90 per cent. in Crawford, Armstrong, and Elk; 85 in Westmoreland and Lehigh; 80 in

Cambria and Clearfield; 75 in Berks, Snyder, and Washington; 65 in Lawrence and York; 60 in Clinton and Susquehanna. Montgomery claims 70 per cent. of post and rail; Sullivan, 67; Dauphin, 50; Union, 42; Clinton, Huntingdon, and York, 30. Bradford reports 90 per cent. of board-fence, Lycoming 50, Clearfield and Luzerne 20, and others declining to 2 per cent. Wayne has 50 per cent. of stone wall, Susquehanna 35, Sullivan 16, Tioga 15. There is a small amount of osage-hedge in Chester, Bucks, Northumberland, Montgomery, Washington, York, and other counties. There is a style of fence known as "rough and ready," used in some counties, made by setting rough posts dressed with an ax on both sides, upon which rails about 9 feet long are nailed alternately on either side; in Fayette 18 per cent. is of this kind. The stone-fence is usually quite substantial, rarely less than 2½ or 3 feet wide at bottom, and 4½ to 5 feet high, though some is lower. The material is various as the kinds of wood in the Pennsylvania forests. Locust and cedar are preferred for posts, and for rails much use is made of chestnut, white-oak, cherry, cucumber, pine, ash, and basswood. The growing scarcity of timber tends to decrease the amount of worm-fence, which is often replaced with post and rail, and with board fence in districts of greater scarcity of timber; and still more substantial forms, as the stone-fence, or osage or other hedge, are growing in favor.

The farms of Delaware are inclosed with worm and post and rail fence, with a small proportion of osage-hedges and other modes of fencing. Kent County reports 60 per cent. of post and rail fence. White oak or chestnut posts, with cedar rails, are much used; and osage-hedges are popular and of thrifty growth.

The zigzag rail-fence surrounds nearly two-thirds of the inclosures of Maryland; post and rail one-sixth; board-fence, stone-wall, pole-fence, and other styles making up the remainder. Chestnut rails and locust posts are largely used. In Kent the osage-hedge is plashed and wattled upon stakes until well grown.

As indicated by returns from forty-one counties, four-fifths of the fence of Virginia is that to which her name is commonly given. Few counties report more than a small proportion of other kinds. Albemarle, Fauquier, and Culpeper have 20 per cent. of post and rail, which is the largest percentage reported. Chesterfield has 60 per cent. of post and board, and Botetourt and Culpeper 20. Rappahannock, Scott, Albemarle, and Fauquier, among other counties, return a fair proportion of stone-wall. In King George the wattling or brush-weaving style is extensively employed, being used for one-fifth of the inclosures. In Scott County black-walnut rails are still used, costing $15 per thousand. Among the material used are found locust, cedar, several kinds of oak, chestnut, poplar, walnut, cucumber, pine, ash, and nearly all other woods of the forest. The legislature of the State has enacted a no-fence law, subject to acceptance by each county, and many have ratified it, and find no inconvenience in the exemption from fences, but the change is received with great satisfaction by the people. The correspondent in Buckingham says of those counties which have no fences that "more crops are raised, and nearly as much stock as before." One correspondent in King George County thus describes the lawful fence of that State:

> A lawful fence must be 4 feet high if made with stone, and 5 feet high if made with any other material, and so close that the beast breaking into the same could not creep through; or with an hedge 2 feet high upon a ditch 3 feet deep and 3 feet broad; or, instead of such hedge, a rail-fence of 2½ feet high, the hedge or fence being so close that none of the creatures aforesaid can creep through.

Throughout the Southern States, a section in every State of which more than one-half of the farm area is woodland, the worm-fence is almost the exclusive mode, except in the vicinity of the better class of buildings. Garden fences are usually of palings. In returns from thirty-seven counties in North Carolina, there is only one record of post and rail fence, 10 per cent. in Sampson County; and in Chowan one-half is board-fence. In Caldwell the "Van Buren" fence is coming into use; the worm 3 feet in width, panels 5 to 10 feet long. A very little of stone-wall and of other kinds appears in a few of the reports. The proportion of worm-fence is 96 per cent. In South Carolina the proportion of crooked-rail fence rises to 98; it is 95 in Georgia and 94 in Florida. In the latter State, stone is placed at 10 per cent. in Gwinnett, and hedge of Cherokee rose is reported in Wilkes and Monroe. The reported height varies from 4 to 6 feet in South Carolina; in most of the counties 4½ and 5, and more reports place the height of North Carolina fences at 5 to 5½ feet than from 4 to 5. Georgia, which represents fairly all this section, makes the average height 5 feet in nineteen counties, 5½ feet in six counties, 6 feet in six counties 4½ feet in four counties, and 4 feet in two counties. Five feet is the legal height fixed for fences in most if not all of the cotton States. The proportion of worm-fence in Alabama is 90 per cent., 10 per cent. representing many kinds, no one of which has much prominence in any locality, except board-fence in Colbert, 20 per cent., and post and rail in Montgomery, 15 per cent. Osage-hedge is marked 10 per cent. in Montgomery. The height of fences is placed quite uniformly at 4½ and 5 feet in this State. For posts, chestnut, oak, and heart-pine are much used.

In Mississippi 95 per cent. are worm-fences, the remainder osage and rose hedges, wire, board, and post and rail; Claiborne County having 28 per cent. of the latter. Half of the counties report all worm-fences. In Claiborne, post and rail fence is made by setting two posts, dropping the rails between, and fastening with caps; wire-fence, by stretching wire upon posts eight feet apart, with a rail or slab-cap from post to post.

Only about two-thirds of the inclosures of Louisiana are surrounded with the Virginia fence. In the parish of La Fayette all fences are post and rail. There are many hedges of Cherokee and McCartney rose, and of osage orange. In the Creole section, a fence made of cypress, and known as *Pieux* fence, is the prevailing style, as in Iberia, where no other is known, and in Saint Landry it amounts to 60 per cent. of the aggregate fencing. It is 5 to 5½ feet high. Slabs of cypress, 9 feet in length, are split from the circumference of the log, in size about 10 by 2 inches, one of which is mortised as a post, for every four tenoned, to be used as boards, making a rough but strong and durable board-fence. In West Feliciana, nearly all inclosures were surrounded by Cherokee-rose hedges; and they were so effectual and popular that most planters cut down all wood except what they reserved for fires and plantation repairs. They died out during the war, probably from frost, and now poles and other make-shifts are common, and every year the destruction of a portion of the crops results. Sugar-planters on the river often fence only on the levee.

Worm-fence constitutes three-fourths of all fencing in Texas. Rail, board, brush, and picket are styles frequently employed, and osage-orange, or *Bois d'Arc*, (from its employment in making bows,) is used in many portions of the State as live fence. Cedar, live-oak, and mesquite are used for posts. The latter, *Prosopis (Algarobia) glandulosa*, is used extensively in brush-fence. Ditches, 5 feet deep, 6 feet wide at top, and 3 feet at bottom, the earth thrown up on the side of the field inclosed,

are made where timber for fencing cannot be obtained readily. In some counties there is only a small area inclosed; "not one rod to one hundred acres" in Hardin. There are sections where stone is obtainable for walls; one-fifth of the fences of Lampasas being made of that material. In De Witt a Mexican fence is built, constructed of logs and brush, piled together 18 inches in thickness, between parallel rows of posts, 7 feet long, set 18 inches in the ground, and 3 feet apart. A citizen of Williamson County proposes the present season to fence five thousand acres with wire, for pasturage.

The worm is almost the exclusive fence of Arkansas, not more than 2 per cent. of other kinds being used, generally 5 feet high; in some cases less, very rarely more. Tennessee has 95 per cent. of the prevailing style; Giles has 15 per cent. of post and rail, and 10 per cent. of stone-wall; Haywood 20 per cent. of lath and orange-hedge, and a small proportion of other kinds is found scattered through the State.

In West Virginia the worm-fence amounts to 85 per cent., the remainder being of almost all kinds in use; some having but seven to nine rails to the panel; in Kentucky about the same proportion, from 4 to 5½ feet high, with post and rail, board, and stone, 4 or 5 per cent. of each. Worm-fences, of eight to ten rails to the panel, are common.

In forty-seven counties in Ohio, the percentage of worm-fence is also about 85, board-fence about 10 per cent., post and rail, stone, picket hedge, and patent fences making the remainder. The height in most localities is from 4½ to 5 feet. The proportion of worm-fence in Michigan is about four-fifths, board being also used quite generally, with a small amount of stone, brush, log, and other structures, and some hedging. The height is in most counties 4½ feet. Indiana, which is well wooded, uses the Virginia style for four-fifths of all fencing. In Lake County there is little else than board-fence; 50 per cent. in Newton, 40 in Warren, and 20 in Switzerland, Fountain, Jefferson, and Vanderburgh. Small quantities of osage-hedge are found in all sections of the State. Worm-fences vary in height from seven to eleven rails to the panel, being highest in the cattle-farms of the southwestern part of the State.

In the prairie States the worm-fence has less prominence. The scarcity of timber limits the use of rails, except for a fence of three or four rails to the panel, with posts, where native wood is to be obtained at all, from margins of streams or artificial plantations of forest-trees. The open prairies, having railroad communication, are fenced with boards from the northern pineries, with cedar and locust posts, if obtainable without great cost, otherwise with oak and sometimes chestnut. In Southern Illinois timber is abundant, and the old-fashioned rail-fence is largely used. From fifty-six counties of Illinois, which may be assumed to represent the State quite fairly, returns make a percentage of 43 for worm-fence and 32 for board, osage-hedge standing next in prominence. Some counties already have a very large proportion of this hedge, viz: Kankakee, 75 per cent.; Henderson and Stark, 50; Marshall, 40; Macoupin, 33; Knox, 30; Rock Island, Warren, Lee, Adams, Madison, Whiteside, 25; and Bureau, Fulton, Peoria, Crawford, 20. It is coming into general use with great rapidity. In Richland osage-hedge is not popular, the expense of trimming being deemed greater than repairs of other fences. In thirty-four counties in which osage-hedges are particularly mentioned, the average percentage is about 20.

Worm-fence constitutes 54 per cent. of the reported fencing of Wisconsin, and board fence 32 per cent. Post and pole, log, brush, stone, ditch, "Shanghai," and various fancy styles, are made. Ingenuity is exercised in prairieregions for the invention and building of fences

requiring the smallest possible amount of material. A hurdle-fence is popular in Rock, supported by short stakes which reach to the third rail, which is longer than the others, thus lapping over and connecting one panel with another.

In Minnesota the proportions of the principal kinds are as follows: worm, 33 per cent.; post and rail, 27; board, 26; and 14 per cent. of other kinds, including (tamarack,) pole, wire, "leaning," and other fences. Average height, about 4½ feet. Oak and pine are used in construction of board fence, while walnut, ash, cottonwood, tamarack, elm, linn, and other woods are used for rails.

No greater variety of fencing exists in any State, than is found in Iowa. An average of 48 county returns indicates 24 per cent. of worm, 23 of board, 14 of post and rail, and 39 of a miscellaneous list of styles, among which osage-hedge is most prominent, reaching 60 per cent. in Cedar, 33 per cent. in Clinton, 25 in Scott, and smaller proportions in many other counties. In Muscatine the proportion of board is 90 per cent., 80 in Harrison, 75 in Scott, and 50 in Henry and Jasper. In Mitchell 63 per cent. is post and rail, and 50 in Carroll and Floyd. The "Shanghai" fence is made of rails, three to five to the panel, laid on the crotches of forked stakes driven into the ground, staked and surmounted with riders. In Mahaska, as in other counties, some inclosures include a dozen farms in a tract of 2,000 acres or more. A "leaning" fence is used in some places, the posts set at an angle of 40°. The "Bloomer" is made with three rails and stakes to the panel. Several counties have no fences, animals being prohibited by law from running at large. Five wires, 8 inches apart, stretched upon posts 8 feet apart, with one stay midway, makes a popular fence in some places.

The worm-fence again predominates in Missouri, amounting to 74 per per cent., while there is 26 per cent. of board-fence, and "corduroy" (poles nailed to posts) hedge, post and slat, stone, palings, "rough and ready," and fancy styles. There is 30 per cent. of osage-hedge in Henry, 20 inGreene, and a large amount of growing hedges in different part of the State. From seven to twelve rails to the panel are used in worm-fences. Post and rail fence is often made with three rails for cattle and six for hogs, and board-fence with three or five boards.

It is difficult to calculate the comparative prominence of styles in Kansas. Averaging the returns, the worm-fence appears to constitute but 18 per cent., board 12, and post and rail 9: leaving 61 per cent. for a great variety of fences reported somewhat indefinitely. The osage-hedge is very prominent, apparently bidding fair to be the principal fence of the State. It is reported at 100 per cent. in Cloud; 50 in Bourbon, Franklin, Linn, and Osage; 40 in Leavenworth; 33 in Douglas; 30 in Anderson. Dickinson reports 400 rods of stone-wall, built at $2 per rod. The Shanghai fence is also found in Kansas. Cherokee county reports fences with names hitherto unheard of, "the eccentricity of whose construction language very feebly conveys."

In many counties of Nebraska few fences are to be found. About 30 per cent. of existing fences are post and rail, 25 per cent. board, and the remainder hedge, wire, Shanghai, and earth-walls 3½ feet high; Hall County having 25 per cent. of the latter.

Board-fence appears to predominate in California; two-fifths being of that style in the counties reported, nearly one-fourth post and rail, and the remainder brush, picket, worm, &c., including a small amount of live willow. Napa and Humboldt have a considerable proportion of worm-fence.

A large proportion, fully 90 per cent. in the returns received, of the

fencing of Oregon, is of Virginia style. The remainder is mainly constructed with boards. A few picket-fences are reported.

In Washington Territory wood is abundant; worm-fence is the prevailing style. Utah has poor material for fencing; is inclosed with poles, brush, post and rail, and inferior forms of fences. Red pine is much used for rails, and aspen poles are abundant. Fence material is scarce in Colorado, except among the mountains. In the dry atmosphere of the mountains, pines, firs, aspen, and other soft woods last well. A Utah correspondent says the aspen will last twenty years if not resting on the ground. There are few fences in New Mexico. There is a law against trespass; and each county is allowed to regulate the time when cattle may be turned loose, which is generally from November 1 to March 1. From corn-planting till harvest is finished cattle must be herded, and the owner is made responsible for any damages they may commit. The Doña Aña correspondent says there is not a rail in New Mexico. Walls are built for small inclosures of adobe, or unburned brick. A fence is sometimes built of cedar poles, set upright and close together, with a horizontal pole bound to each upright, near the top, by strips of raw-hide an inch wide. In Arizona and Nevada small poles are much used for fencing, though a small area only is inclosed.

In recapitulation it will be seen that worm-fence predominates in Vermont, New York, and in all the States west and northwest of New Jersey, except Kansas, Nebraska, California, and Nevada, and the Rocky Mountain region, though but slightly in Vermont, Minnesota, and Iowa. Its proportion in the former States exceeds that of all other kinds combined, except in Vermont, New York, Illinois, and Iowa, in the latter constituting scarcely one-fourth of the total fencing. It may fairly be ranked as the national fence, though it is temporary, giving way gradually to kinds requiring less lumber, and covering less land, as well as making a less awkward appearance not at all indicative of the straight-forwardness of the American character. Board-fence is the prevalent style in California, and next to worm in Vermont, New York, in all the Southern States south and west of Maryland, (though the percentage is still small,) and in all the Western States in which worm-fence predominates, except Minnesota and Nebraska. The post and rail style is the main fence in New Jersey, and stands second to other kinds in Maine, Massachusetts, Pennsylvania, Delaware, Maryland, Minnesota, and Nebraska. Stone-wall is the principal fence in Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut; and the next in prominence in New Hampshire, Rhode Island, and Connecticut, is board-fence. For hedges, the osage orange stands first, being already in efficient condition in Illinois, and largely planted west of the Mississippi; while it is coming gradually into use in all of the Middle and Western States south of the fortieth parallel of latitude, and, to some extent, for ornamental purposes in the Southern States. The Cherokee and McCartney rose (botanically, *Rosa laevigata* and *R. Macartnea*,) are preferred by many as hedge-plants in the States of the Gulf coast. The white willow, *Salix alba*, and other plants are employed for hedging purposes to a very limited extent. The following table shows the proportion of the principal kinds of fence in the several States, as averaged from the reports:

Proportion of each kind of fence.

States.	Worm.	Post and rail.	Board.	Other kinds.	States.	Worm.	Post and rail.	Board.	Other kinds.
Maine	5	17	11	67	Texas	74	......	7	19
New Hampshire	8	6	35	51	Arkansas	98	......	1	1
Vermont	30	11	27	32	Tennessee	95	1	2	2
Massachusetts	6	31	3	60	West Virginia	85	5	6	4
Rhode Island	......	10	11	79	Kentucky	87	4	5	4
Connecticut	24	30	13	33	Ohio	86	1	9	4
New York	45	18	19	18	Michigan	79	......	8	13
New Jersey	29	62	4	5	Indiana	81	1	10	8
Pennsylvania	67	17	12	4	Illinois	43	2	32	23
Delaware	50	45	......	5	Wisconsin	54	2	32	12
Maryland	65	14	3	18	Minnesota	33	27	26	14
Virginia	79	2	4	15	Iowa	24	14	23	39
North Carolina	96	......	3	1	Missouri	74	2	10	14
South Carolina	98	......	1	1	Kansas	18	9	12	61
Georgia	95	......	......	5	Nebraska	3	29	25	43
Florida	94	......	3	3	California	5	22	41	32
Alabama	90	1	1	8	Oregon	92	......	8	......
Mississippi	95	1	1	3	Nevada and Territories	5	14	5	76
Louisiana	61	8	......	31					

Gates.—Many descriptions are received of different styles of gates used, with plain drawings in many cases; but the variations are so numerous and wide, even in the same State, and the description in many instances so indefinite and incomplete, that it would be impossible to attain perfect accuracy in an exhaustive exposition. The gates of wooded regions are of a heavier pattern, and those of the settled States which have not given place to recent improvements are very clumsy in construction and movement. The common slat-gate is in very general use. The balance pole is largely employed in nearly all sections of the country, especially in the older settlements. Gates turning upon hinges, fastened with "hook and eye," moving in a socket, those with wooden latches and every imaginable style of fastening, are found of such variety and form of material and mode of construction as almost to defy description. Lattice-gates and fancy styles are common near dwellings and in the vicinity of towns. The tendency in the new farming regions is to lightness of material, facility of movement, and cheapness, with the requisite degree of strength. Many of them are patented. Large numbers of new patterns are built in the Western States at $1 to $2 each. Perhaps the most popular is a slide-and-swing gate, which moves back on rollers part way, balances on a pivot in the post, and turns round at right angles. In many counties in the South, few, if any gates, are reported, while in others nearly all the openings are gates; in a few there are neither gates nor bars, but "slip gaps." The correspondent in Henry County, Virginia, says that the fields there are entered by pulling down a corner of the fence; that it becomes less substantial every time it is taken down, until it will no longer restrain stock, when "the exasperated farmer rights it up, props it, and perhaps cuts thorn rushes to lay upon it, and finally pulls down another portion of the fence where the same experiment is repeated."

The following table gives the estimated percentage of openings guarded respectively by gates and bars, and the average cost of gates. A small proportion of the inclosures of certain States have neither gates nor bars. It is, of course, understood that these statistics include only farm-gates:

States.	Percentage of gates.	Percentage of bars.	Cost of gates.	States.	Percentage of gates.	Percentage of bars.	Cost of gates.
Maine	34	65	$2 33	Texas	35	47	$4 81
New Hampshire	33	66	2 6[illegible]	Arkansas	29	45	5 22
Vermont	19	80	3 50	Tennessee	37	36	4 50
Massachusetts	10	90	6 25	West Virginia	33	67	2 71
Rhode Island	31	68	7 66	Kentucky	36	55	5 17
Connecticut	22	78	4 12	Ohio	49	47	3 89
New York	27	72	3 85	Michigan	33	65	3 47
New Jersey	24	76	6 25	Indiana	52	45	3 60
Pennsylvania	24	76	4 55	Illinois	67	29	3 54
Delaware	25	75	4 50	Wisconsin	43	53	3 15
Maryland	48	51	4 96	Minnesota	29	71	2 66
Virginia	52	43	4 71	Iowa	36	62	2 96
North Carolina	40	57	3 33	Missouri	49	40	3 75
South Carolina	49	45	4 14	Kansas	43	51	3 60
Georgia	37	46	3 10	Nebraska	31	68	2 04
Florida	47	53	3 25	California	74	26	7 00
Alabama	33	61	3 21	Oregon	40	60	8 00
Mississippi	64	35	4 53	Nevada and Territories	38	62	4 53
Louisiana	44	45	6 00				

The average proportion of bars, in the whole country, is about 53 per cent.; of gates, 43; leaving about 7 per cent. of openings for slip gaps or other mode of entrance.

COST OF FARM-FENCES.

Cost of material.—A great variety of material is used for board-fences. Of course, inferior qualities of lumber are taken—that which is rough and knotty, or those kinds of wood less in request for house-finishing or furniture-making. Where oak is abundant, it is often employed; hemlock and spruce are used largely in New England, New York, and elsewhere, as other timber increases in value; and the cheaper grades of pine are extensively used in the Northwest, and culls from oak, poplar, ash, and other woods.

The average cost, as reported, is given in the accompanying table, from which it appears that boards used for fences are dearest in Texas, costing $29.53; $28.95 in Kansas; $27.88 in Nebraska; $27 in Delaware, and $25.66 in Rhode Island. The cost is least in Georgia, $12; $12.37 in Oregon; and $12.85 in Florida. The cost of rails are highest in New Jersey; next in order, Nevada, Rhode Island, Massachusetts, and Connecticut. The lowest figure is $8.12 per M, in Florida; then Georgia, Alabama, South Carolina, and Mississippi.

Price of material.

States.	Boards, per M.	Rails, per M.	States.	Boards, per M.	Rails, per M.
Maine	$9 80	$71 66	Texas	$29 53	$39 32
New Hampshire	11 25	60 00	Arkansas	17 78	15 66
Vermont	12 33	47 50	Tennessee	15 20	19 50
Massachusetts	21 64	106 42	West Virginia	15 86	22 27
Rhode Island	25 66	120 00	Kentucky	18 75	27 56
Connecticut	24 61	102 85	Ohio	17 58	35 29
New York	16 01	68 12	Michigan	12 72	23 60
New Jersey	23 00	130 00	Indiana	16 50	30 69
Pennsylvania	15 99	56 26	Illinois	21 00	45 51
Delaware	27 00	65 00	Wisconsin	14 81	28 56
Maryland	22 88	59 51	Minnesota	18 88	37 00
Virginia	15 74	16 51	Iowa	24 51	59 56
North Carolina	11 45	10 44	Missouri	23 25	37 20
South Carolina	13 50	11 83	Kansas	28 95	67 91
Georgia	12 00	10 95	Nebraska	27 88	64 44
Florida	12 85	8 12	California	19 54	99 28
Alabama	13 88	11 64	Oregon	12 37	48 00
Mississippi	19 07	12 50	Nevada and Territories	53 50	120 00
Louisiana	24 00	23 00			

Cost of fences per rod.—There is a great difficulty in estimating the cost of fences, from the variety and differing value of material used, and the many kinds of fences built, as well as the differences in their height, massiveness, and thoroughness of construction. The best built fences in the United States are in Rhode Island, if the returns are correctly made, and their average cost is the highest. The best fences are of stone, and they are also cheapest, repairs costing little, though their first cost exceeds that of any other kind.

The cost of fences, as stated below, is lowest in the Southern States. It is deemed best to give the averages of the figures returned for those States, though they do not adequately express the real cost. It is stated in many of these returns that the price per rod returned is simple the cost of "mauling the rails" and laying them, without counting expense of teams for hauling, and in some cases of board while doing the work. Nothing is reckoned usually for the value of timber, and the estimate is often based on the bare wages of hands employed by the month. The work is done by tenants as odd jobs, or in the winter interval between cotton-picking and cotton-planting, as one of the requirements of their contract, and so the expense is scarcely considered. While giving these averages as they are made in this table, an enlarged estimate, intended to include all the actual elements of cost, is used in calculating the total cost of farm-fences, which may be found in a subsequent table. The returns are very complete as to the cost per rod of worm, post and rail, board, and stone fences, but not so full as to the various other kinds. The estimate of average cost per rod in each State is based upon prices and proportions of each kind of fence.

Cost per rod.

States.	Worm.	Post and rail.	Board.	Stone-wall.	States.	Worm.	Post and rail.	Board.	Stone-wall.
Maine	$0 66	$0 83	$0 72	$1 64	Texas	$0 87	$0 80	$1 44	$2 47
New Hampshire	65	82	86	1 37	Arkansas	43	1 25	1 21	1 50
Vermont	95	91	1 00	1 52	Tennessee	50	77	1 09	3 27
Massachusetts	1 38	97	1 31	2 75	West Virginia	67	1 27	1 48	2 96
Rhode Island	2 00	2 06	2 58	2 33	Kentucky	71	1 71	1 64	4 22
Connecticut	1 37	1 64	1 67	2 42	Ohio	79	1 06	1 38	3 20
New York	1 10	1 25	1 47	2 45	Michigan	71	1 06	1 26	2 16
New Jersey	1 61	1 61	1 61	2 50	Indiana	75	1 07	1 39	2 95
Pennsylvania	95	1 35	1 26	2 34	Illinois	99	1 27	1 31	3 56
Delaware	1 00	1 33	1 70	......	Wisconsin	63	77	99	2 75
Maryland	1 08	1 94	1 96	2 66	Minnesota	65	72	99	......
Virginia	43	1 17	1 16	2 13	Iowa	91	94	1 31	......
North Carolina	33	44	93	......	Missouri	88	1 02	1 43	2 81
South Carolina	35	43	76	......	Kansas	1 08	96	1 27	2 96
Georgia	31	49	99	......	Nebraska	1 00	97	1 42	......
Florida	30	37	78	......	California	1 22	1 59	1 30	3 50
Alabama	34	1 04	1 05	......	Oregon	96	......	1 02	......
Mississippi	43	87	1 57	......	Nevada and Territories	1 38	1 75	2 20	......
Louisiana	60	1 25	3 00	......					

Amount and cost of fencing.—The inquiry was made for "the number of rods of fence to each one hundred acres of farm-lands, including together improved and unimproved lands." As a few in the older States, and many in the South and West, answered with reference only to the "improved" acres, it was deemed proper, in calculating the acres fenced, to avoid an exhibit erroneously large, to exclude one-fourth of the unimproved area in the New England States, (with the exception of Maine,) the Middle States, and Maryland; one-half in the unimproved portion of farms in the States of the Ohio Valley and lake region, between Kentucky and Wisconsin, and in Maine; three-fourths of unimproved lands

in the States between Virginia and the Mississippi, where only the "improved" area is usually reckoned as the farm; all of the unimproved land in Virginia, (where a no-fence law has been enacted,) Florida, and Louisiana, where water boundaries save much fencing; and in Minnesota, Iowa, Kansas, Nebraska, and California, where some improved land is unfenced, only three-fourths of the improved area was taken.

In calculating the number of rods of fencing, the estimate of the number of rods to each one hundred acres was carefully made from the returns, as follows:

States.	Rods to 100 acres.	Cost per rod.	States.	Rods to 100 acres.	Cost per rod.	States.	Rods to 100 acres.	Cost per rod.
Maine	713	$1 00	South Carolina	500	$0 80	Indiana	680	$1 05
New Hampshire	875	1 20	Georgia	546	75	Illinois	475	1 20
Vermont	775	1 33	Florida	464	72	Wisconsin	525	85
Massachusetts	850	1 75	Alabama	610	80	Minnesota	400	88
Rhode Island	1,000	2 20	Mississippi	420	96	Iowa	420	1 10
Connecticut	910	1 70	Louisiana	400	1 00	Missouri	525	1 00
New York	825	1 35	Texas	440	1 10	Kansas	425	1 10
New Jersey	925	1 60	Arkansas	590	95	Nebraska	400	1 05
Pennsylvania	955	1 15	Tennessee	655	95	California	425	1 40
Delaware	625	1 20	West Virginia	900	90	Oregon	450	1 05
Maryland	630	1 25	Kentucky	600	95	Nevada	400	1 50
Virginia	500	90	Ohio	860	1 00			
North Carolina	560	75	Michigan	800	95			

From all this data, the calculation of amount and cost of fences in the United States leads to the following result:

States.	Acres fenced.	Rods of fencing.	Total cost of fencing.
Maine	4, 377, 925	31, 214, 605	$31, 214, 605
New Hampshire	3, 288, 117	28, 771, 023	34, 525, 227
Vermont	4, 164, 917	32, 278, 106	42, 929, 880
Massachusetts	2, 481, 767	21, 095, 019	36, 916, 283
Rhode Island	448, 988	4, 489, 880	9, 877, 736
Connecticut	2, 185, 000	19, 883, 500	33, 801, 950
New York	20, 549, 909	169, 536, 749	228, 874, 611
New Jersey	2, 736, 251	25, 310, 321	40, 496, 513
Pennsylvania	16, 374, 641	156, 377, 821	179, 834, 494
Delaware	963, 770	6, 023, 562	7, 228, 274
Maryland	4, 112, 936	25, 911, 496	32, 389, 370
Virginia	8, 165, 040	40, 825, 200	36, 742, 680
North Carolina	8, 902, 909	49, 856, 290	37, 392, 217
South Carolina	5, 284, 224	26, 421, 120	21, 136, 896
Georgia	11, 035, 877	60, 255, 888	45, 191, 916
Florida	736, 172	3, 415, 838	2, 459, 403
Alabama	7, 536, 947	45, 975, 376	36, 780, 300
Mississippi	6, 437, 137	27, 035, 975	25, 954, 536
Louisiana	2, 045, 640	8, 182, 560	8, 182, 560
Texas	6, 822, 757	30, 020, 130	33, 022, 143
Arkansas	3, 294, 189	19, 435, 715	18, 463, 929
Tennessee	10, 027, 762	65, 681, 841	62, 397, 748
West Virginia	4, 067, 289	36, 605, 601	32, 945, 040
Kentucky	13, 381, 978	80, 291, 868	76, 277, 274
Ohio	18, 090, 776	155, 580, 673	155, 580, 673
Michigan	7, 558, 040	60, 464, 320	57, 441, 104
Indiana	14, 111, 963	95, 961, 348	100, 759, 415
Illinois	22, 606, 406	107, 380, 428	128, 856, 513
Wisconsin	8, 807, 332	46, 238, 493	39, 302, 719
Minnesota	1, 857, 681	7, 430, 724	6, 539, 037
Iowa	7, 517, 173	31, 572, 126	34, 729, 338
Missouri	12, 274, 766	64, 442, 521	64, 442, 521
Kansas	1, 576, 802	6, 701, 408	7, 371, 548
Nebraska	517, 624	2, 070, 496	2, 174, 020
California	4, 974, 504	21, 141, 642	29, 598, 298
Oregon	1, 116, 290	5, 023, 305	5, 274, 470
Nevada	74, 115	296, 460	444, 690
Total	250, 505, 614	1, 619, 199, 428	1, 747, 549, 931

Average rods per acre, 6.46. Average cost per acre, $1.08.

Cost of repairs.—The annual cost of repairs of fences varies with the cost of material of which they are constructed, and the durability of that material. It is comparatively low in the New England States, on account of the large proportion of stone-wall in that section; and low in the South because of the abundance and cheapness of material. It is undoubtedly too low in that section, few of the reports recognizing any value whatever in the wood used for rail-splitting. The cost is relatively high in the older States, where timber is becoming scarce, and in the prairie States, which are nearly destitute of home supplies. In the Rocky Mountain section the cost is increased in consequence of the perishable nature of the material employed, much of it being brush or poles of soft woods. The true average, as nearly as possible, of the figures received from the several counties reporting in each State, have been taken as a basis of the calculation, and the resulting total cost of repairs for all the States, (not including Territories,) is $93,963,187—a total which may be accepted at a low estimate. A proper allowance for low estimates in the Southern and some of the Western States, would make it fully equal to the annual interest on the cost.

States.	Cost per 100 rods.	Total cost.	States.	Cost per 100 rods.	Total cost.
Maine	$3 06	$955,166	Kentucky	$5 15	$4,035,031
New Hampshire	3 80	1,093,298	Ohio	5 25	8,167,985
Vermont	4 00	1,291,124	Michigan	4 00	2,418,572
Massachusetts	4 50	949,275	Indiana	5 40	5,181,912
Rhode Island	5 75	258,168	Illinois	9 50	10,201,140
Connecticut	7 50	1,491,262	Wisconsin	4 55	2,103,851
New York	7 06	11,969,294	Minnesota	5 10	378,966
New Jersey	9 80	2,480,411	Iowa	9 80	3,094,068
Pennsylvania	6 32	9,883,078	Missouri	4 90	3,157,683
Delaware	7 50	451,767	Kansas	6 75	452,345
Maryland	7 80	2,021,096	Nebraska	8 50	175,992
Virginia	3 51	1,432,964	California	8 50	1,797,039
North Carolina	3 40	1,695,113	Oregon	7 50	376,747
South Carolina	4 00	1,056,844	Nevada	9 00	26,681
Georgia	4 00	2,410,235			
Florida	3 80	129,801			
Alabama	4 65	2,137,853	Total cost of annual repairs		93,963,187
Mississippi	5 26	1,422,092			
Louisiana	6 51	532,684	Interest on the original cost at 6 per cent		104,852,995
Texas	8 50	2,551,712			
Arkansas	5 92	1,150,594			
Tennessee	5 00	3,284,092	Grand total, exclusive of rebuilding of fences		198,806,182
West Virginia	4 50	1,647,252			

This exhibit makes the cost of fences nearly equal to the total amount of the national debt on which interest is paid, and about the same as the estimated value of all the farm animals in the United States. For every dollar invested in live stock, another dollar is required for the construction of defenses to resist their attacks on farm production. Experiment has proved that at least half this expense is unnecessary. Wherever it has been tried, wherever farm-animals are restrained, and their owners are placed under (fence) bonds for the good behavior of their restless dependents, the system is regarded with general and growing satisfaction, capital is released from unprofitable investment and made available for farm improvement, soiling is encouraged, the manurial resources of stock husbanded, and the way prepared for larger production and higher profit. Even where a herd law of some sort has not been enacted, the tendency is strong, as many correspondents assert, toward the reduction of the amount of fencing; as repairs are needed, division fences are taken down and the material

used to keep outside fences in repair; fields are almost everywhere becoming larger; in the younger States, a single field often answers all requirements, and sometimes a single inclosure embraces within its bounds many farms. The entire town of Greeley, in Colorado, with its suburbs for gardens and small market farms, is surrounded with a single fence, the cattle being excluded and kept outside upon the illimitable plains. It is possible to dispense with fencing to the value of one thousand million dollars, and the advantages of the change would greatly overbalance the inconvenience of it. Let the farmers discuss the subject in the light of actual experiment, rather than under the influence of ancient prejudice, and their views will soon coincide with their true interests.

DONATIONS TO MUSEUM.

Name.	Residence.	Article.
Adams, T. G	Washington, D. C	Silk-moth, *Attacus cecropia.*
Akhurst, John	Brooklyn, L. I	Silk-worm eggs, *B. mori.*
Andrews, J. F	Manassas, Va	Specimens of wool.
Anderson. H. G	Graytown, Tex	Snakes and ants.
Antisell, Thomas	Washington, D. C	Cundurango wood.
Army Medical Museum	......do	Photograph of a corn-cob, resembling a human hand. Insect, *Dynastes tityus.*
Austin, E. P	Boston, Mass	Alcoholic insects.
Baker & Hench	Eshcol, Pa	Apples for modeling.
Birgfeld, A	Washington, D. C	Three varieties of corn.
Bliss, B. K., & Son	New York City, N. Y	Samples of potatoes.
Boerner, C	Vevay, Ind	Leaves injured by gall insects. Galls on burr-oak.
Bonelli, Daniel	Saint Thomas, Nev	Two varieties of dried raisins from Nevada.
Brewer, Captain	Washington, D. C	Corn millet from Senegambia.
Brown, James C	Barnwell, S. C	Tumel maki, moina, and common prolific cottons.
Brummell, J. H	Washington, D. C	Sacks of Indian manufacture from Bogota, South America.
Bryant, A. H. R	Clarksville, Tex	Insects and specimens of natural history.
Burpee, E. P	New London, N. H	Specimen of excelsior oats.
Burton, Hon. A. A	Secretary Santo Domingo Commission.	Specimens of crude and refined wax, coffee, cocoa, sugar-cane, &c.
Butterfield, O. E	Wilmington, Vt	Samples of maple-sugar.
Capron, Hon. H	Yeddo, Japan	Japanese papers, silks, silk-worm eggs, seeds, &c.
Chapman, George T	New York City	Beet sugar; made in London.
Clark, A. F	Newton, N. C	Tumel maki cotton.
Coates, Lanning	New Zealand	Wheat and oats.
Cook, Thomas R	Victoria, Tex	Wild hemp. (?)
Dean, William S	Hornellsville, N. Y	Crystalized maple-sugar.
Deitz, W. H	Kingston, Tenn	Insects.
Denegre, Taylor	New Orleans, La	Machine-cleaned ramie.
Downward, James	Wilmington, Del	Sisal hemp.
Erne, H	Basle, Switzerland	Silk-woven sashes, badges, &c.
Findley, S. M	——, Ill	Grain from burned elevator, from Chicago, Ill.; hazel-nut, and curious growth of a sweet-potato vine.
Fleming, J	Toronto, Canada	Twenty specimens of grain, seeds, &c.
Frederich, William	Eddyville, Iowa	Large corn, two samples.
French, L. L		Bees-wax.
Gabb, William M		Specimens of seeds.
Gardener, William	Hawaiian Islands	Specimens of nuts, seeds, &c.
Getty, A	Washington, D. C	Insects.
Glover, Townend	......do	Foreign game-birds, sixteen specimens.
Goodrich, William	Paxton, Ill	Sorghum-sugar, two specimens.
Green, William N	Troy, N. Y	Specimens of manzenita and cocoa wood from California and West Indies.
Hall, J. C	Argentine Republic	Alpaca-wool.
Hartt, Ch. Fred	Prov. do Para, Brazil	Guarana-paste.
Heaton, J. C	Lavaca, Tex	Texas cocoons, (*B. mori,*) arrow-heads; horned frog.
Hilliard, C	Northfield Farms, Mass	Specimens of pop-corn.
Heiligbrodt, L	Austin, Tex	Collections of insects.
Helmus, William	Washington, D. C	Large asparagus.
Herstine, D. W	Philadelphia, Pa	Buff Cochin, Brahma, and other fowls.
Holden, Thomas W	Boston, Mass	Mammoth potato.
Horn, Dr., G. H	Philadelphia, Pa	Collection of beetles.
Hutchings, J. M	Yosemite Valley, Cal	Insect food of Indians from Mono Lake, Cal.
Japanese Government		Samples of paper, &c., from Japan.
Jennings, Dr., S. K	Coatopa, Ala	Samples of cotton.
Jewell, Dr. J. G	United States consul, Singapore, India.	A variety of paper made from the bark of a tree.
Johnson, D. A	Griffin, Ga	Egyptian and other cottons.
Johnson, Henry	Washington, D. C	Birch bark from Maine.
Keenan, J. R	Brook Haven, Miss	Bear-grass and other fibers; apples; Indian relics.
Kingsbury, W. G	San Antonio, Tex	Cocoons of an ichneumon fly.
Kron, F. A	Albemarle, N. C	Egyptian cotton.
Kullberg, W	——, Sweden	White-beet sugar made at Stockholm, Sweden, 1870.
Lake, Preston	Jackson County, Iowa	Specimens of fiber.
Lewis, R. F. R	Commander United States steamer Resaca.	Specimens of cotton, New Zealand flax, coffee.
Lockhart, J. L	Ligonier, Ind	Egyptian wheat.
Lyman, J. D	Exeter, N. H	Large collection of corn.
Mallett, Prof. J. W	University of Virginia	Specimens of rosin, &c.
Marble, W. H. C		Spring-wheat grown by Mr. Hill, on Big Thompson, Colorado.
Mechling, Mrs. F. E. J	Belize, British Honduras	Specimens of insects, reptiles, &c., in alcohol.
Morton, J. W	Nashville, Tenn	American-grown opium.
Moulton, M. M	Monticello, Iowa	Locusts, (Cicadas.)
Nunes, Robert	Philadelphia, Pa	Lace bark from Jamaica.
Oliver, M. N	Cincinnati, Ohio	Pears, Mrs. Jackson, (seedling from Seckel), and Duchesse D'Angouleme.

Donations to museum—Continued.

Name.	Residence.	Article.
Oudesluys, Charles L	Baltimore, Md	Five samples of beet-sugar, from Scotland.
Palmer, Dr. E	Washington, D. C	Indian food, &c., two lots.
Palazetto	Prince George County, Md	Club gourd from Mount Ætna.
Parry, Dr. C. C	Washington, D. C	Specimens of fibers, fruits, grain, tobacco, &c., from Santo Domingo.
Patterson, J. M	Alameda County, Cal	Sample of French merino wool.
Rives, W. H	Washington, D. C	Houdan egg, (weight 4¼ ounces.)
Robeson, Secretary	do	Specimens of cotton from Tahiti.
Rodgers, G. A	London, Pa	Rodgers's white winter-wheat.
Rosenhammer, M	Rattlesnake, Cal	California blue-jay, and wool of cashmere goat.
Schliecker, P. F	Baltimore, Md	Specimen of asbestos from Maryland.
Scoggins, S. R	do	Singular fish, five feet long, from Potomac River.
Sells, Miles	Saint Louis, Mo	Nine samples of cotton taken from premium bales, Saint Louis fair.
Shields,		Specimens of insects.
Shumacher, P	Santo Domingo	Fiber of *Fourcroya cubense.*
Smith, jr., Jos		Prolific corn.
Smithsonian Institution	Washington, D. C	Books eaten by white ants; specimens of insects, &c.
Speltman, W	Enterprise, Miss	Tumel maki cotton.
Sprague, Amasa	Providence, R. I	Samples of Peeler cotton and manufactures from the same.
Steele, E	Yreka, Cal	Wheat.
Stewart, C. B	Montgomery, Tex	Fiber of cotton-stalks; ramie and okra fiber.
Taylor, A. S	Santa Barbara, Cal	Specimens of *Orthoptera*, (grasshoppers.)
		Eggs of gold, silver, and English pheasant; chicks of silver pheasant, and adult ♂ golden pheasant.
Turner, David C	Washington, D. C	Large specimens of fungi.
Thomas, Cyrus	De Soto, Ill	Collections of insects.
Ulke, Henry	Washington, D. C	Specimens of insects.
United States Consul	——, China	Chinese mulberry and oak feeding silk-worms and specimens of silk, cotton, grains, seeds, &c. Province of Manchuria, China.
United States consul	Malta	Esparto grass.
Do	Yedo, Japan	Fruit of seedless persimmon.
Unknown		Beet-sugar samples.
Do		Insect, (*Tropæa luna.*)
Do	Albany, N. Y	Apples and vegetables.
Do		Asbestos.
Do		Sponge-cucumber fiber.
Do	Devall's Bluff, Ark	Collection of insects, &c.
Do		English beet sugar.
Do		Insects from Panama.
Victor, H. C	San Francisco, Cal	Fiji Island cotton and Tappa.
Walker, J. M	Talbot, Va	Specimen of Gloria Mundi apple.
Ware, Annie I	Washington, D. C	Vegetable wool.
Welsh, Prof. A. S	Ames, Iowa	Specimens of fruit to model.
Wolter	Washington, D. C	Mole crickets from China.

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